Engineering
News-Record
Devoted to Civil Engineering and Contracting
July 24, 1974

—and on smaller buildings, too

A few of the many smaller buildings that have been "roofed for permanence" are shown on this page.

Federal Cement Tile is made for flat and pitched surfaces.

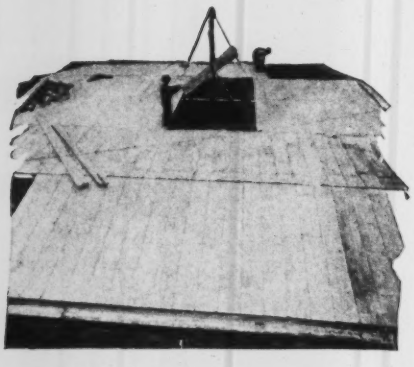
—fire proof Federal Roofs have proved cheaper than the inflammable kind

A MAN who knows how to figure roof costs once said of an inflammable roof:

"It isn't cheap, it only *looks* cheap." And that is an unanswerable argument for Federal Cement Tile.

There seems to be an idea prevalent, particularly among builders of small structures, that the cheaper the appearance of a roof and the more unsightly it is, the lower its cost.

In the files of the Federal engineering department there is an abundance of proof that a Federal Roof is actually more economical than the ugly, inflammable kind.



Since a Federal Roof is fire proof, it saves in insurance rates. Steam, gases, rain, snow and the other destructive forces that ruin other roofs merely season and strengthen this concrete tile—as a result, maintenance is wiped out. More surprising still to many owners of smaller buildings is the fact that even the first cost of Federal Cement Tile compares very favorably with covered wood roofs, particularly when installed on pitched surfaces.

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FRANK C. WIGHT
Editor

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Seasonal Construction

SEASONAL construction is a bad habit. There are no physical reasons why building and most other kinds of construction are not practicable all the year around. These, broadly, are the conclusions of the committee of experts appointed by Secretary Hoover and working with the Department of Commerce since last fall to determine the degree of and reasons for seasonal operations in the construction industry. The committee at present has issued only a summary, as outlined in this issue, of its determinations. The full report, a volume of considerable magnitude, is now going through the publisher's hands and will be available, it is announced within two months. Without the full report extended comment on the committee's work and conclusions is impossible. While the conclusions are interesting that it is custom and not climate which reduces construction in winter and that to change the custom education of the building public to the habit of year-around operations is necessary, it is the findings of fact that are fundamental. The length which the full report shows the committee to have gone in disclosing the facts determines the technical value of its labors. The complete report will be awaited with interest.

Why Not a Five-Year Census?

SINCE every city considers increasing size something to be sought and boasted about there will be mingled congratulation and complaint at the Census Bureau estimates of populations of our large cities, recently announced as of July 1. America as a whole will unite in congratulating itself on learning that it has a population of 112,000,000, that New York has passed the 6,000,000 mark, Chicago nearly reached half and Philadelphia nearly a third of that figure, and going down the line, that no less than 11 cities passed into the 100,000 class in a single year, bringing the total number to 79. But there will be some cities that will protest that their rapid growth since 1920 entitled them to the 100,000 class and others, although above that class, will protest that they should be ranked higher than they are. To all these contentions the one reply is that an exhaustive statistical study, made twenty years ago by Prof. Walter F. Willcox of Cornell University and published as a census bulletin, shows that the fairest method of estimating populations between census years is the one used by the Census Bureau ever since, the arithmetical, in which the percentage increase is the same for every city. Where local indications impress the Census Bureau with the unreliability of this method it attempts no estimate, as is the case this year as regards eight cities—Detroit, Los Angeles, Seattle, Denver, Akron, Bridgeport, Houston and Spokane. Obviously, however, this is a makeshift method of determining population between the decennial censuses. Yearly estimates are needed for hundreds of statistical and other purposes. So large and rapidly growing a country as ours should not be dependent upon population estimates ranging over ten years. We should have a census every five years. This would be a relatively simple and inexpensive task if it were limited to the population.

A New Field for Insurance

RECENTLY this journal received a letter from a director of a large and expensive toll bridge in the Northwest, asking if we could inform him where he could obtain an insurance policy on the bridge. Here is a new field for insurance, for, so far as we know, no company has ever endeavored to protect a bridge owner against possible damage or failure after it was completed and in service. It is generally understood that Lloyds of England will insure anything. With proper investigation of the risk, and sufficient volume of business, there should be possibilities here worth investigating.

Rainfall and Rain

CONSTRUCTION programs have been put from four to six weeks behind schedule in large sections east of the Rocky Mountains by excessive rains in May and June. From New Jersey, from Kentucky and from Missouri come reports of rain on 15 to 20 days out of every 30 days in the two months named. A look over the precipitation records, however, shows no great increase in rainfall over the normal for either month. For example in Kentucky in June the rainfall was only 1.05 in. over normal but it rained on 15 of the 30 days. The fact to be observed is that it is frequency of rain and not volume of rainfall which interferes most seriously with construction. Had the 5.16 in. of rainfall in Kentucky in June come in downpours on three days instead of in drizzles on 15 days contractors would have worried little. This situation shows how important it is that engineers and contractors put their minds to devising means of reducing rain delays. It is not a task of creating barriers against the cloudburst or even the drenching downpour. These can be bowed to and the work stopped and few days will be lost. The real task is to ward off the effects of the short sharp shower or to keep work going through an all-day drizzle. Are they beyond the resource of invention of engineering and contracting?

Separate Contracts Denied

A RESOLUTION against separate contracts for mechanical installations in building construction has been announced by the Interdepartmental Board of Contracts and Adjustments. Among the reasons named is the one that separate contracts take away any advantage from utilizing a general contractor's organization

for and power of properly timing and co-ordinating the various parts of the work. This recognition of the management function of the general contractor cannot be over-emphasized. It is often overlooked by the force account construction advocate and the owner who decides to save money by himself "subletting" the work. Somewhere in any large construction operation involving several trades there must be centralized management and single responsibility. If they are not had through a general contractor, the owner must himself provide them. In brief, the personalitiy of the general contractor can be eliminated but his business function must then be assumed by the owner either directly or through an agent. And be it remembered too that in assuming the general contractor's business function the owner also assumes his risks. Incidentally it is the risk element of its service that has made contracting, according to the report of the income tax unit, the most hazardous of all production industries. In deciding against separate contracts the Interdepartmental Board has performed another of the many wise actions with which it is to be credited.

The Highest Arch Dam

SPAIN now claims the honor of having the highest dam of a pure arch type, the Montejaque Dam, standing 210 ft. high above the stream bed and only 55 ft. thick at the thickest point. We have built many so-called arch dams in this country that are as high, or higher, than this new one in Spain, but they do not depend entirely on arch action for their stability. It remained for Swiss engineers, developing a site in Spain similar to many in our Western states, to make full use of the natural advantages of the site by throwing an arch dam across the canyon. In America, we are prone to think of Europeans as being much more conservative than we are, but in engineering at least this does not seem to be the case. Years ago, a French engineer raised a great steel tower at Paris that still remains the tallest structure in all the world, despite the skyscrapers of New York; quite recently other French engineers built a reinforced-concrete arch of much greater span than any ever attempted in this country; and now Swiss engineers have done what we have talked about a great deal, but have never attempted on so large a scale. In the case of high buildings, it is probable that utility has been the governing factor, but in the case of high dams, and to a lesser extent in long span concrete bridges, considerations of safety have been the controlling factors in design. In such cases American engineers have preferred to increase the cost in order to make doubly sure that the structure would stand. Doubtless this has been a wise policy; nevertheless we cannot but admire the spirit of the Swiss engineer who has staked his reputation on a structure like the Montejaque Dam.

City Folk Safer from Typhoid at Home

IT HAS long been true for most of our cities and towns that their inhabitants were safer at home than in the country, so far as danger from typhoid is concerned. Even in the days of high typhoid in urban districts "vacation typhoid" was held responsible for the autumn rise in the typhoid curves. As the annual typhoid curve has fallen toward the base the autumnal rise in many cities has become more noticeable. Gradually the countryside has become a safer place, but the typhoid menace still lurks there. Latterly it has been increased by campers, trampers and automobilists. The more progressive states and communities are safeguarding the campers on permanent sites and the people in the vicinage by rules and inspections but these do not affect chance camps for the night, noon-day or other short stops beneath a waterside tree, or the hiker, the fisherman or the hunter.

That these dangers are greatest where thousands of acres of hill, valley, streams and forest have been devoted to public recreation has been strikingly illustrated in the last few weeks by the 72 cases of typhoid fever and four deaths (up to July 20) in New York City alone attributed to drinking polluted water in the Pallisades Interstate Park, a portion of which lies across the Hudson River from the upper part of New York City. The park as a whole lies in two states and although, as a park, it is under the control of one commission, in health matters it is controlled by two state and many local health departments. This addition to the long list of examples of vacation typhoid is all the more unfortunate because it comes in territory within the jurisdiction of two states with long established reputations for public-health work.

The moral of this tale is not that because city people are safer at home they should stay there. The net health gain from journeys to the countryside, whether for a few hours, days or weeks, is great. The people who go there must be protected—*and they must learn to protect themselves* by using discretion as to what they eat and drink on their outings.

Not only this, all journeying through and sojourning for a time in the country *should learn to protect others* as well as themselves from the dangers of camp and waterside infection.

The rules to be observed are so simple and obvious to sanitary engineers and health officers that they wonder at their widespread non-observance. A moment's reflection will lessen the wonder. A trip to and through the country, with its release from all sorts of city-made restrictions, begets a feeling of freedom which, if not curbed by reason and a regard for the safety of oneself and others, will lead to carelessness and rebellion. All this and much else our park and health authorities must consider in making and enforcing rural sanitary regulations.

Power as a World Issue

TECHNICAL advantages will doubtless flow from the first World Power Conference recently held in London. The four hundred odd papers, when collected in the four large volumes it is predicted they will make, will constitute an admirable record of present-day practice in power development and transmission and will, in addition, put on record for the first time a fairly complete statement of the power resources of the globe, habited and uninhabited regions alike. But these advantages, which will accrue to all those who read the proceedings, and the advantages of contact which those fortunate enough to attend the conference will derive, are small beside the effect the conference, as the forerunner of similar conferences in the future, may have on world thinking and world progress. Power, as everyone who discusses it remarks, controls our present civilization. Without power we would relapse into the barbarism—or at least the simplicity—of the middle

ages. How to produce and increase power, how to get it to its users effectively and cheaply, how to control it to the best benefit of everyone, are problems intimately tied in to the progress of the world in the next century.

Engineers are studying these problems; they are as a part of their every-day work trying to devise the ways and means of developing and applying power to the world's needs. They see not only the technical difficulties and necessities but they realize full well the social and economic changes that power demands and in its turn will produce. But the importance of power is beginning to be understood beyond the circles of those responsible for its production, and in consequence it is beginning to take on the aspects of political issue. Nothing has done more to educate the people at large to the implications of power in their daily life than the famous Ford effort to obtain Muscle Shoals, with its consequent widespread educational campaign in the press to show what is involved in the perpetual bestowal upon an individual and his assigns of the millions of horsepower in a running stream. This educational process is only just begun. The country is filled with half-informed enthusiasts who do not understand the economics of power development, who think, as some one has said, that all that is necessary to generate power is to stick a couple of wires in a falling river, and who are obsessed with the notion that there is some essential thievery connected with the private production and sale of power. These people, in our country particularly, need more instruction. That instruction is bound to come as the demands for power development grow and the financing of both private and public power enterprises become more open and better understood than they are at present.

But so far this social problem has been confined to each country. With minor exceptions there is no international transmission of power. Each nation has been working out its own economic control of power to suit its own demands. Such a conference as that just held at London can do nothing more for this phase of the question than it can for the purely technical details of power development; that is, it permits experts to interchange views. But sooner or later the problem will take on world importance. The growing human demands, increasing at a greater rate even than the increasing population, will make it necessary for the world to consider its power resources as a whole, regardless of national boundaries. For a long time, to be sure, each country will seek to develop and control its power to its own benefit, but sooner or later the sheer pressure of economic law will force some kind of agreement as to the places where power is to be developed, the uses to which that power is to be put and the rules and practices by which it, and the products it makes possible, are to be transmitted and sold.

All this sounds like the novelist's dream of the world state. That may be true, but if there ever is to come a world state or even an approach to it in the way of perpetual fraternity of nations, the demands of power and the means of satisfying those demands are going to be the controlling factor in its formation. For that reason, the World Power Conference is significant; not so much because of its present importance or its effect on the life of the present generation but because it marks the first attempt of the technicians of the world to get together and to impress upon the statesmen of the world the part that power will play in the future.

Breaking the Jersey Water Monopoly

THE stranglehold on sources of water supply for a large part of northeastern New Jersey which private interests have for decades sought to maintain is released in part by the recent chancery court decision holding that Newark has a right to sell its surplus Pequannock water. The marvel is that thirty-five years have elapsed without the contract clause at issue being brought into court and declared void, as it now has been, because a violation of the long-accepted doctrine that restraint of trade is against public policy and will not be tolerated if brought to the bar of equity or justice.

For years Newark had more Pequannock water than it could use and was surrounded by communities which had to buy water, but it could not sell nor they buy because Newark in purchasing its water-supply system from the East Jersey Water Co. agreed not to sell the Pequannock water which was involved outside certain territory, which the company desired to serve. That this put not only Newark but a number of other municipalities at a disadvantage has been shown again and again. It was illustrated by the direct causes of the lawsuit just decided and further illustrated in the recent purchase by Montclair of the local water distribution system, one of the bargaining points in which was that the same company would permit Montclair to buy water from Newark. These private water interests have repeatedly sought court orders against other attempts of New Jersey municipalities to be masters of their water supplies. Even now the company is seeking to restrain some ten municipalities, including Newark and Montclair, from developing the Wanaque supply through the North Jersey District Water Supply Commission.

Forty years ago New Jersey had a State Water Supply Commission. It laid down a plan of water supply which, had it been followed, would have resulted in public ownership and control of sources of water supply for all the more densely settled parts of the state. The public was apathetic. Private interests were alive. They acted. Hundreds of thousands of people have been blocked or at best hampered in the proper development of their water supplies ever since. Not only that, some of the communities, like the Elizabeth-Plainfield section, have been in and are in danger of water famine because neither they or the water companies that supply them have found a way out of the impasse into which all of them have drifted.

The company cannot be blamed so much as the municipalities for the water monopoly conditions that have so long prevailed in New Jersey. The cities and towns have been apathetic or supine for four decades. It is time that they arouse themselves to strong united action and rid themselves of the water monopoly root and branch—nothing less will avail. If this cannot be done by purchase at a reasonable price then every mooted point should be tested in the courts as rapidly as possible so as to learn to a certainty what rights the municipalities and the state of New Jersey have in the Passaic River and its feeders. The alternative is a policy of delay and attrition—the municipalities pitted against a company which through the entrenchment of possession of water and of old franchises and contracts, some running back a hundred years, has shown itself a master in the field of water monopoly.

High Arch Type Dam Built in Southern Spain

American Methods and Equipment Used on Montejaque Concrete Dam in Andalusian Mountains—Crushed Rock and Sand Quarried and Prepared at the Site—Two Types of Form Used

By M. E. Wegenstein
Zürich, Switzerland

NOT UNTIL the last decade has the rapid development of hydro-electric resources, which has been so notable in other countries, been undertaken in Spain. Now, however, foreign capital, taking advantage of the cheap native labor, has gone into the country and has commenced the work so long delayed. Two large new plants are already in operation, one at Camarasa with a capacity of 88,000 hp. (*Engineering News-Record*, Aug. 17, 1922, p. 260) and one at Tremp with

FIG. 1—UPSTREAM FACE OF THE MONTEJAQUE DAM
Showing portion of dam poured by direct chuting; remaining concrete placed by ¾-yd. concrete carts.

a capacity of 60,000 hp., and now the one at Montejaque is rapidly approaching completion.

The Montejaque project, although smaller than the other two, has a dam which is of unusual interest because of its size and the methods used in its construction. It is located on the Gaduares River in the western part of the Province of Malaga, in a very mountainous part of the country at the point where the river enters the Montejaque Gorge. Here nature offers a splendid dam site. The two opposite cliffs rise almost vertically from the sides of the river to a height of several hundred feet, so that the shortest distance between them at an elevation of 250 ft. above the river bed is still less than 200 ft. The rock is a solid limestone of the Jura formation and offers a good foundation. Here the Compania Sevillana de Electricidad has built a concrete arch dam having a maximum height of 273 ft. from the lowest point in the foundation to the crest, a 7,200-ft. pressure tunnel in solid rock, a surge chamber, a penstock line, and a power house with three turbines, having a combined capacity of 25,000 hp. and working under a maximum head of 900 ft. The spillway has been located some 200 ft. from the dam in solid rock, and will have a capacity of 12,400 sec.-ft.

The dam is of the pure arch type. In conformity with the modern static method of determining the working stresses in concrete arch dams, this one is arched on a variable radius, which increases from 72 ft. at the base to 123 ft. at the crest, the length of which, measured along the center line, is 256 ft. (crest elevation 2,470 ft. above sea level). The maximum width of the dam at El. 2,247 amounts to only 55 ft. and decreases to 10 ft. at the top (El. 2,470). The completed structure contains 35,000 cu.yd. of concrete and forms a reservoir for 1,412 million cu.ft. of water. On account of the relatively small quantity of concrete to be placed and the very small width of the dam, no plums were used on this job.

Actual work on rock excavation was begun in July, 1923, and the dam was completed early in June, 1924, only a few days after the date set in the contract. Due to this short construction period the contractors planned and installed very complete and efficient mechanical equipment for handling materials and aggregate and for placing concrete.

Crushed stone and sand were obtained from a limestone quarry, located about 1,500 ft. from the dam site. With great charges of from 1 to 1½ tons of dynamite the mountain was blasted down in quantities of from 6,000 to 8,000 cu.yd. at a time. The larger rocks then were broken up with one-man rock drills, compressed air being furnished by a 16x10x14-in. compressor driven by an 80-hp. motor, to which later a compressor of smaller size had to be added.

Partly in ¾-cu.yd. dump carts, partly in 3-cu.yd. buckets, handled by a stiff-leg derrick with a 70-ft. steel boom, the materials were brought to the crusher plant. There a gyratory crusher, driven by a 102-hp. motor, and a sand mill, driven by a 75-hp. motor, broke and pulverized the stone, which was generally hard and tough, making excellent aggregate. The properly sized materials dropped onto a 24-in. belt-bucket conveyor, passed through a 48-in. x 16-ft. rotary screen and were stored in bins with a total capacity of 520 cu.yd. From

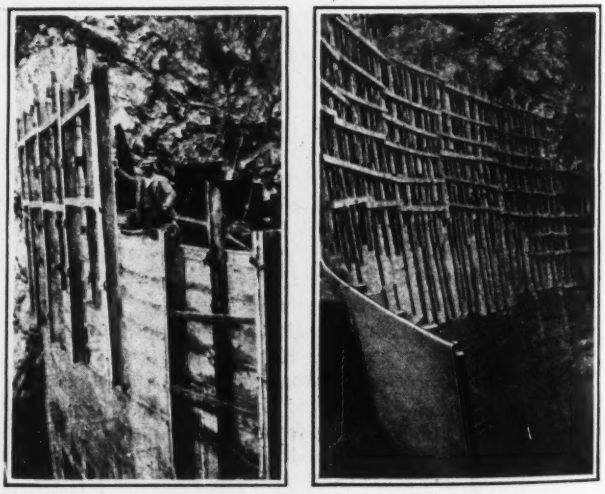

FIG. 2—DETAILS OF THE FORMWORK

these bins crushed stone and sand were loaded into V-type dump carts in which they were brought on a 2-ft.-gage track to a second set of bins which held 1,000

cu.yd. of material and were located directly above the mixing plant. The cars ran on a 1½ per cent incline, each car carrying its own brakeman.

The mixing plant consisted of one 1-yd. and two ½-yd. motor-driven concrete mixers equipped with batch hoppers. Measuring hoppers taking stone and sand through radial gates from the bins were located directly above the mixer hoppers.

Cement was received in sacks from railroad cars at the Montejaque station. There it was loaded on motor trucks which hauled it up to the dam site; first following for about three miles the state highway to Jerez, where a specially constructed gravel road 16 ft. wide and 2½ miles long, and having a maximum incline of 8 per cent, extended to the site of the dam. As mules are very plentiful in Spain, it proved to be of advantage to engage 100 to 150 of these animals to carry the cement from the railroad station over mountain trails directly to the dam site when bad weather made the new road impassable for heavy trucks. Each mule could carry from three to four sacks.

The three mixers discharged into one general hopper, from which a constant flow of concrete was maintained, during concreting, in the channel leading to the elevating tower. This wooden tower measured 231 ft. above the bottom and was built in 7 ft. 8 in. bents of 8x8-in. posts, 2x8-in. stringers and cross-braces. It measured 8x8 ft. out to out. The cross-bracing was placed on the outside and the stringers on the inside of the posts for the additional stiffness to the tower gained thereby. Every 38½ ft. the tower was held in vertical position by a set of four diagonal 1-in. cables, fastened to the ground. The tower was equipped with a tower elevator bucket of 60 cu.ft. working capacity, which dumped into an 84-cu.ft. tower hopper and was operated by a hoist driven by a 75-hp. motor. The tower supported a 1-in. cable which terminated at anchors drilled and grouted into the solid rock of the left cliff of the gorge at about 130 ft. distance. From

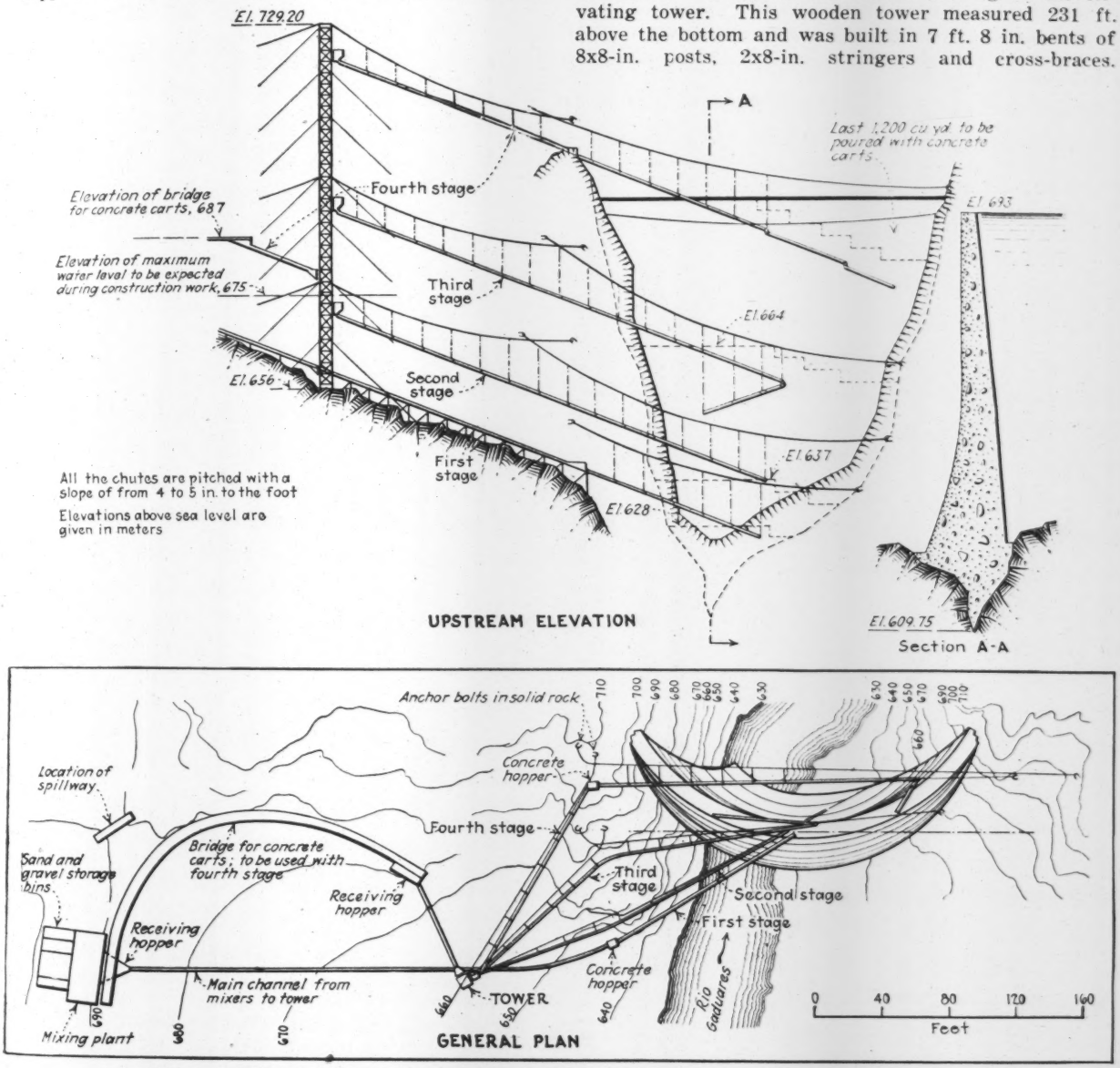

FIG. 1—DETAILS OF THE PLANT LAYOUT AT VARIOUS STAGES OF THE CONCRETING

there a double 1-in. cable crossed the gorge high above the dam. From the main cables ½-in. steel cable were dropped down to support the ropes and blocks carrying the chutes.

Elbow chute connections on the lower end of the chute line together with secondary cables spanning the gorge made it possible to cover any part of the dam surface, which for the lower two thirds had an average length of 160 ft.

For the dangerous and difficult work about chutes the contractors brought with them a crew of men specially trained and used to this kind of work; all the other laborers, some 350 to 400 in all, were recruited from the villages and farms of the neighborhood.

The concreting program for the dam was divided into four different periods. On account of the favorable location selected for the mixing plant, the whole of the foundation and the lower part of the dam itself were concreted without the use of the tower or hoisting equipment. Then the first tower 69 ft. high was erected and the cables from the tower to the left cliff as well as the cables across the gorge were mounted at the

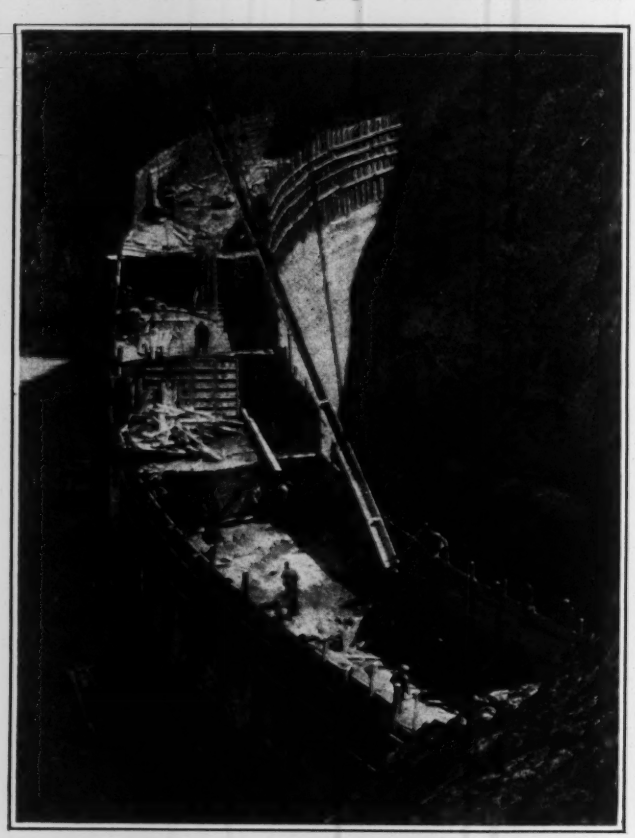

FIG. 4—RAISING THE FORMS FOR A NEW POUR
Men on floats are finishing the surface

corresponding elevation. Later the tower was raised to a height of 138 ft., another set of cables installed and the chute line raised a second time. At the final tower height of 231 ft. it was possible to bring part of the dam up to its full height by direct chuting. The final 1,200 cu.yd. were placed with ¾-yd. concrete carts.

The chutes were semi-circular in form, 14 in. wide inside and 8¼ in. deep and made of No. 12 gage metal. They were used in 10-ft. and 20-ft. sections connected by flexible joints generally used with continuous line chutes.

Since the two sides of the dam were not to receive

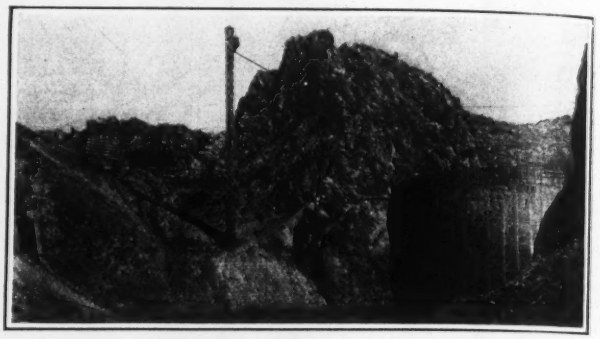

FIG. 5—MIXING PLANT, TOWER AND CHUTES
Pressure tunnel intake at extreme left

any masonry facing, special attention had to be given to the formwork. For the downstream face of the dam wooden panel forms 3 ft. 4 in. high and 6 ft. 8 in. long were used. The vertical posts were 3x4 in. x 6 ft. 8 in. spaced 40 in. and connected by horizontal beams of same dimensions and equal spacing. After the day's concrete had been poured steel hooks were driven into it about 4 ft. inside the forms. On these hooks the horizontal beams of the next stringer of panels were anchored by wiring.

For the upstream face steel forms were used exclusively with the exception of both extreme ends of the face. There the gaps between the last steel forms and the irregular rock line were closed by wooden planks. The steel panels were of standard No. 12 gage sheet iron, 8 ft. high and 12 ft. long. The vertical posts consisted of double 10-in. channels 16 ft. long spaced 3 ft. apart. The two channel webs of each post were spaced 1 in. apart so as to leave room for the ¾-in. anchor bolts by means of which the lower half of the post was fastened tightly to the old concrete. Between the posts the panels were reinforced by horizontal 2½x3x½-in. angles, riveted onto the plate. The anchor bolts were 3 ft. long and had a steel cap screwed on the inside end which permitted their being screwed out and used another time.

The dam was built in 4-ft. layers, which corresponds to one half of the height of the steel forms.

The quarry, crusher and mixing plant were designed to place an average of 270 cu.yd. of concrete per 8-hour day. According to that output, the total surface of the dam was divided for concreting into two or three sections, each of which averaged 1,700 sq.ft. The greatest quantity of concrete poured during one day, 450 cu.yd., was made with the tower at the 60 ft. height.

H. E. Gruner, consulting engineer of Basle, Switzerland, designed the dam. The contracting firm of Remy y Cia., with head office in Barcelona and employing Swiss engineers, had the contract for the construction of the dam and the diversion tunnel. With the exception of the two ½-cu.yd. Swiss concrete mixers, the whole construction equipment used was of American origin.

Repairing Steel Floor Framing Damaged by Corrosion

Water From Restaurant Floor Attacks Steel—Dowel Rods Put Through Webs of Beams and Embedded in New Concrete

EXTENSIVE corrosion of floorbeams and girders in the basement of the Republic Building, Chicago, was discovered in rearranging the interior, after a restaurant had occupied this floor for seventeen years, or since the building was completed. The floor framing consisted of girders in one direction, formed in some cases of two I-beams and in other cases of plates and angles. Between the girders were I-beam joists forming floor panels approximately 6 x 20 ft. In Fig. 1 are shown a girder attached to the column at the right and two I-beam joists, all drilled for dowel rods as reinforcement. The original and reinforced construction are shown in Fig. 2.

The floor slab of reinforced concrete was supported on the bottom flanges of the joists, the concrete extending

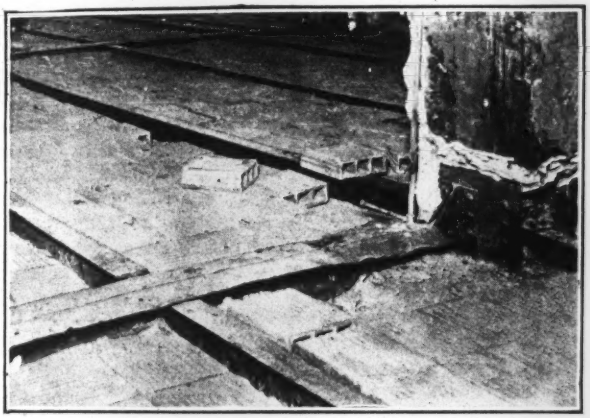

FIG. 1—FLOOR FRAMING UNDER REPAIR

Old slab covered with tile filling to carry new floor. Holes cut in beam webs for dowel rods. Flange angles and beam flanges thinned by corrosion.

6 in. above and 2 in. below the soffit of the joist. Upon this slab was a filling about 6 in. thick, consisting of cinder concrete in which was embedded a considerable quantity of broken tile and brick; on the fill was a floor topping of sand and cement. The concrete slab was reinforced by means of flat steel strips clipped to the underside of the joists and there is some suggestion that the concrete below these strips may have been poured separately from that above them, using a finer aggregate in order to fill around the steel. There was little damage to this concrete, except that in a few places the concrete below the steel had broken loose from the upper portion of the slab. This occurred over the boilers located in the sub-basement and may have been due to the excessive heat, to water seeping through from above, or to both these conditions.

Injury to the structural steel occurred only in the portion of the basement occupied by the restaurant kitchen, where the floor topping was badly cracked and offered easy access for water, some of which doubtless contained salt. Furthermore, the damage occurred only in the upper part of the beams, above the concrete slab. No damage was found where the stone concrete was in contact with the steel. There was extensive pitting of the beams and girders and in a few places there were perforations of the web, while the flanges were materially reduced in many places. At the column connections there was considerable corrosion, but not enough to affect the strength of the column. The electric conduits were completely destroyed.

In repairing the floor, all of the cinder concrete was removed and the steel thus exposed was thoroughly cleaned with a sandblast. Load tests on the concrete slab and joists showed that they were safe, but never-

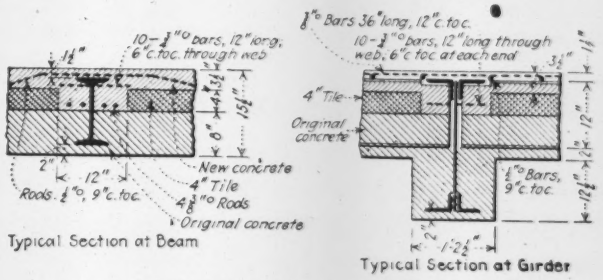

FIG. 2—REINFORCEMENT OF CORRODED STEEL FLOOR FRAMING

theless it was decided to reinforce the steel members and to install on top of the beams a reinforced-concrete floor slab that would be capable of carrying the imposed loads. As the height available for this additional concrete slab was more than needed, a 4-in. tile filling was used to keep the dead-load approximately the same as that of the original floor.

The tile fillers were set back from the beams to leave space for reinforcing the top flange with a block of concrete 12 in. wide and 7½ in. deep (see Fig. 2). This concrete was anchored to the beam by means of dowels or rods through the webs, spaced about 6 in. apart; it was further reinforced by means of rods parallel to the web of the beam and by the reinforcing rods of the slab, which were at right angles to the beam. This reinforcing was done on the basis of making the combined concrete and structural steel section act as the compression flange of the beam and at the same time protecting the beam against further corrosion.

The experience with this building indicates the importance of the installation of waterproof floors in spaces that are to be used for kitchens, or that are otherwise subjected to flooding.

Test Alumina Cement for Concrete Pipe

In order to get information on the behavior of alumina cement in concrete pipe, I. F. MacDowell, sanitary engineer of the County of Cuyahoga, Cleveland, Ohio, recently made some tests on finished pipe. While the alumina cement was not used for the pipe line, which had already been contracted for, Mr. MacDowell was very well impressed with the possibilities that the quick setting quality would be of value in saving time and pipe casting. One 54-in. pipe made of the standard concrete for this type of pipe, using alumina cement instead of portland cement, was tested at the age of 24 hr. The pipe stood a total load in pounds under the standard A.S.T.M. pipe test of 38,510 lb., with only a few cracks which were not all the way through the walls of the pipe, The required load for a 28-day-old concrete pipe with portland cement was 38,400 lb.

Spiral Curves Cut Costs of North Carolina Road Work

Searle's Railway Spiral Adapted to Road Work Reduces Surfacing and Grading Costs, Simplifies Field Surveys and Cuts Down Office Computations

BY CHARLES M. PRITCHETT
Locating Engineer, State Highway Commission, Asheville, N. C.

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SPIRALING of highway curves has been adopted as standard practice by the North Carolina State Highway Commission. Calculations for these spirals are based on a highway curve whose functions require no corrections. The general design follows Searle's railway spiral, with adaptations necessary for highway work. Spirals have decided usefulness in highway construction. They enable the maximum road surface to be utilized when necessary. They provide a means of widening the curves for safety, and at the same time function in superelevating.

Center Line Spiral—All railroads spiral the center line. With one exception, all highway commissions that I know of spiral the inside edge, usually with fixed radii and 20-ft. intervals—why, I do not know. It certainly costs money. The delay to the locating party is material in fitting and figuring these curves. I have noted intermediate curves that would save 40 cu.yd. of excavation on construction. On an extensive program where 1,000 of these short radius curves may be under construction per year the loss is very material, both on location and on construction. The new North Carolina spiral table is designed and laid off from the center line curve of even degrees, insuring simplicity and accuracy. It does not limit the locating engineer. Any transitman can figure the curves without loss of time to his party. The party chief can fit his line to the country instead of compelling the construction men to fit the country to his line.

Throw—The throw of the spiral is its most important feature in highway work. This should not be less than the thecretical extra width required on any curve for the passing of the longest motor vehicles on the road. The amount is dependent on the length of the car for any given curve.

The graph Fig. 1 shows the theoretical width of roadway required for three lengths of cars as well as the amount provided by the North Carolina standard for an 18-ft. pavement on all curves. Clearance is the difference between the two. It is practically constant for a 23-ft. machine. It increases uniformly with the degree of curve for the shorter machines, insuring greater safety. Maximum speed is regulated in all states, by law. Any provision beyond this limit is a waste of money and an encouragement to speeding. The throw indicated is considered safe and conservative with the speed limit of 30 miles—North Carolina law. The dotted lines shown on the graph were plotted from the standard spiral sheets of certain states. On the theory of proportioning the width to the danger of the curve, they represent an average absolute waste of $28.16 on a 200-ft. widened curve of hard surfacing at $2.75 per square yard. This will amount to $30,000 a year on an extensive job.

Length—In developing the spiral it was found that a 100-ft. length would give the desired throw. In the mountains it was not always possible to obtain a 100-ft. tangent between curves, and a 50-ft. transition curve was adopted to supply the need. This is neither a true spiral nor a lune. The offsets on the transition curve vary as the square of the distance up to the *P.C.* Beyond this the curves are compounded so as to give uniform variation as near as possible and still be tangent at the *S.C.* In the 150-ft. spiral the same offsets are used as in the 100-ft. spiral, the distance between them being changed to 15 ft. instead of 10 ft. This procedure was impossible on the 50-ft. transition curve, as it would give a reverse curve just after passing the *P.C.*, the spiral limit a straight line having been exceeded. The length of spiral does not materially affect the extra area involved in widening any given curve. The slight difference favors the longer spiral.

The innumerable curves require some uniformity and simplicity in the spirals, if they are to be constructed economically and intelligently. With this end in view Table II has been designed.

Details—Referring to Table I the details are:

L = length of spiral = 100 ft.

C = length of spiral chord (it is taken short enough to practically equal the arc it subtends) = 10 ft.

C' = radial projection of chord on center line.

R = radius of center line curve.

R' = radius of curve the spiral enters = $R - P_m$. It is the radius for the curve of $(n + 1)$ chords. R' can only be determined by trial. (This is done to avoid shifting the center of the original curve which would involve complications.)

Curve Economics

Until the official adoption of the spiral, a modification of a well known "Standard," which is represented by one of the dotted lines on the graph Fig. 1, was used. It cost at least $33,000 per year unnecessarily—probably double this figure would be nearer the truth. The losses were due to (1) the unnecessary widening of smaller curves (approximate loss $29,000); (2) the delay in fitting and figuring curves with fixed radii (approximate loss $2,000); (3) the delay in figuring and staking out spirals from the tangent (approximate loss $2,000); (4) the loss in construction yardage, due to the inability of the locating engineer to select curves that would fit the country with specified 20-ft. intervals (loss undetermined); (5) the specification calling for $\Delta - 2I$ not less than one-third the central angle (loss undetermined). When $\Delta - 2I$ is specified not less than one-third the central angle it often forces the selection of a larger R than will fit the country. One chief of party recently estimated a saving of $15,000 in one job of heavy mountain work by this change.

TABLE I—DETAILS OF SPIRAL FOR 50-DEG. CURVE

		(L = 100		C = 10	Q = 49.54		R = 114.59	R' = 110.09')				
N	D	CA.	I	Inc.	10 x sin	Y	10 x cos.	X	I	P	C'	Def.
1	4°-44'	0-28	0-28	0-14	0.0407	0.04	9.9999	10.00	.....	.....	.....	0°-14
2	9 -28	0-57	1-25	0-56½	0.1644	0.21	9.9987	20.00	.....	.....	.....	0 -36
3	14 -12	1-25	2-50	2-07½	0.3708	0.58	9.9931	29.99	.....	.....	.....	1 -06
4	18 -56	1-54	4-44	3-47	0.6598	1.24	9.9782	39.97	.....	.....	.....	1 -46
5	23 -48	2-22	7-06	5-55	1.0308	2.27	9.9467	49.92	0°-11.6'	2.27	.....	2 -36
6	28 -24	2-50	9-56	8-31	1.4810	3.75	9.8897	59.81	5 -17.6	3.42	10.28	3 -35
7	33 -08	3-19	13-15	11-35½	2.0094	5.76	9.7960	69.60	10 -26.6	3.93	10.30	4 -44
8	37 -52	3-47	17-02	15-08½	2.6121	8.37	9.6528	79.26	15 -37.8	4.29	10.37	6 -02
9	42 -36	4-16	21-18	19-10	3.2832	11.65	9.4457	88.70	20 -49.5	4.46	10.39	7 -29
10	47 -20	4-44	26-02	23-40	4.0141	15.67	9.1593	97.85	25 -02	4.50	10.41	9 -06
11	52 -04	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

Q = the distance from the $P.C.$ to the $T.S.$ = X-R' sin I.

n = number of chords = 10.

D = degree of curve at any point of spiral. The variation is uniform and D_n represents as near as may be the curve of R' radius. A slight variation does not materially affect the result.

CA = The central angle subtending any arc and is always = $D \times C/100$.

I = the spiral angle or the sum of the CA's for any given point.

Inc. = the angle of inclination which any chord makes with the tangent and = $CA/2$ + the preceding I.

10 × sin (of inclination) is the departure of any chord.

Y is the sum of the departures.

10 × cos (of inclination) is the latitude of any chord.

X is the sum of the latitudes.

P is the radial offset from the center line curve. It is figured from the corresponding value of X.

Def. = the deflections from the $T.S.$

The simplest way of laying out the spiral is by deflection, using the constant chord length C. The points when found are of no value on highway construction. What we want is the outside and inside edge of pavement. As these points have to be projected, it saves time to project them from the center line without laying out the spiral.

It will be noticed that the values of X to the $P.C.$ and C' to the $S.C.$ are variable, no two of them being identical, though the variation is small. The total length of the spiral when projected on the center line is $Q + \frac{26° - 02'}{50°} \times 100 = 49.54 + 52.06 = 101.60$.

By arbitrarily making X = 10 a constant on the center line, the maximum variation of the shifted spiral from the theoretical will be 0.03 ft. at point No. 8. In practical work the variations for these shifts are negligible, as few forms are ever set to exact line. Having a uniform whole number for laying out distances on the center line is a very material aid in field work with green men, the only practical difference in results being that the total length of the spiral is shortened by 1.60 ft. This decreases with the degree of curve. The shift, of course, changes the value of I.

Crown Elimination—Elimination on the spiral works a hardship on the contractor and requires extra care on the part of the engineer in securing a neat job. An automobile in coming off of a superelevated curve on the outside has an adverse slope from the $P.C.$ to the $T.S.$ to aid any tendency of the machine to slide on a wet pavement. By eliminating the crown at the rate of 1 in. to 10 ft. before reaching the $T.S.$ both of the above conditions are avoided.

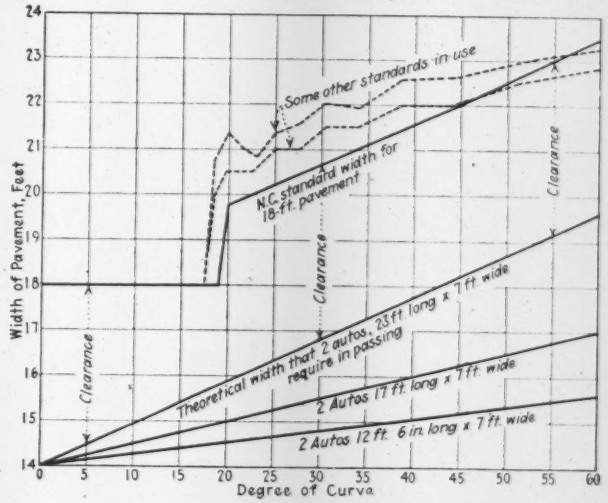

Some other standards in use
N.C. standard width for 18-ft. pavement
Clearance
Clearance
Clearance
Theoretical width that 2 autos, 23 ft. long x 7 ft. wide require in passing
2 Autos 17 ft. long x 7 ft. wide
2 Autos 12 ft. 6 in. long x 7 ft. wide
Width of Pavement, Feet
Degree of Curve

FIG. 1—THEORETICAL AND ADOPTED EXTRA WIDTHS ON HIGHWAY CURVES

Superelevation—There is a wide divergence of opinion as to the proper rate of superelevation. It can be figured for any given condition, but I know of no road where a given set of conditions may be applied to its usage. The present tendency of practice is to increase the superelevation. Fig. 2 shows the average practice throughout the United States as near as could be compiled. The amounts shown in Table II conform approximately to this average practice, though it is expressed in feet rather than inches for simplicity in calculation.

There are some objections to any given method of

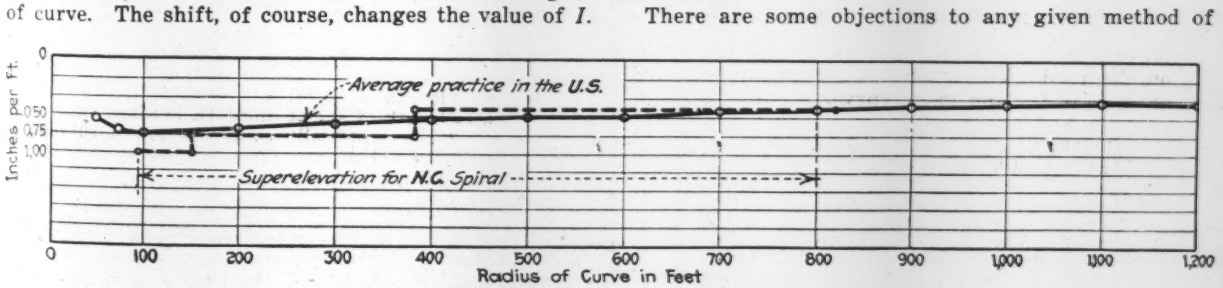


FIG. 2—GRAPH OF CURVE SUPERELEVATION

TABLE II—OFFSETS IN FEET FROM THE CENTER LINE TO BE ADDED TO $W/2$ FOR THE INSIDE EDGE

Radius of Curve R	Degree of Curve D	Spiral Angle I	Distance Between Points on the c for Setting Offsets X	Distance From P.C. to T.S. θ	Perpendicular T.S. Y_0	1 Y_1	2 Y_2	3 Y_3	4 Y_4	P.C. Y_5	Radial 6 P_6	7 P_7	8 P_8	9 P_9	S.C. P_{10}	Superelevation per Foot of Width from the S. C. to the C. S. Ft.	Widened Area Subtended by Ft. of Circular Arc on Center Line Sq.Yd.	Widened Area Subtended by Two Spirals Sq.Yd.	
286.50	20	5°-00′	5	25	0.00	0.04	0.14	0.32	0.56	0.88	1.15	1.37	1.55	1.67	1.77	0.06	0.195	9.230	
272.86	21	5 -15				0.04	0.15	0.33	0.59	0.93	1.23	1.42	1.60	1.75	1.86		0.206	9.650	
260.45	22	5 -30				0.04	0.15	0.34	0.61	0.95	1.25	1.48	1.66	1.83	1.91		0.207	9.949	
249.13	23	5 -45				0.04	0.16	0.36	0.64	0.97	1.25	1.52	1.72	1.88	1.99		0.220	10.222	
238.75	24	6 -00				0.04	0.17	0.38	0.67	1.01	1.36	1.66	1.83	1.98	2.11		0.233	10.865	
229.20	25	6 -15				0.04	0.18	0.40	0.70	1.05	1.37	1.70	1.90	2.07	2.20		0.243	11.223	
220.38	26	6 -30				0.05	0.18	0.41	0.73	1.08	1.45	1.75	1.98	2.13	2.26		0.249	11.507	
212.22	27	6 -45				0.05	0.19	0.43	0.76	1.12	1.50	1.83	2.08	2.23	2.36		0.261	12.095	
204.64	28	7 -00				0.05	0.20	0.45	0.79	1.16	1.56	1.90	2.18	2.35	2.48		0.274	12.611	
197.59	29	7 -15	5	25	0.00	0.05	0.20	0.46	0.82	1.21	1.62	1.98	2.25	2.42	2.56		0.280	13.047	
191.00	30	7 -30				0.05	0.21	0.48	0.85	1.26	1.67	2.03	2.32	2.50	2.64		0.291	13.420	
179.06	32	8 -00				0.06	0.22	0.50	0.88	1.30	1.75	2.10	2.43	2.62	2.76		0.304	13.942	
168.53	34	8 -30				0.06	0.24	0.54	0.95	1.40	1.86	2.25	2.62	2.84	2.98		0.328	14.947	
159.17	36	9 -00				0.06	0.26	0.59	1.02	1.53	2.00	2.47	2.85	3.06	3.20	0.06	0.352	16.119	
150.79	38	9 -30				0.07	0.27	0.61	1.08	1.66	2.25	2.67	3.03	3.25	3.37	0.08	0.370	17.321	
143.25	40	10 -00				0.07	0.29	0.64	1.15	1.79	2.33	2.83	3.20	3.44	3.59		0.394	18.137	
127.33	45	11 -15				0.08	0.32	0.72	1.28	1.95	2.60	3.15	3.58	3.85	4.00		0.437	19.949	
114.60	50	12 -30				0.09	0.36	0.80	1.44	2.15	2.88	3.50	4.03	4.32	4.50		0.489	22.013	
104.18	55	13 -45				0.10	0.40	0.89	1.59	2.38	3.18	3.88	4.43	4.75	4.96		0.538	23.920	
95.50	60	15 -00	5	25	0.00	0.11	0.44	1.00	1.76	2.65	3.55	4.26	4.86	5.28	5.50	0.08	0.592	26.148	50 Ft. Spiral
286.50	20	10°-00′	10	50	0.00′	0.02	0.08	0.23	0.48	0.88	1.29	1.54	1.67	1.75	1.77	0.06	0.195	18.988	
272.86	21	10 -30				0.02	0.09	0.24	0.50	0.92	1.35	1.63	1.78	1.84	1.86		0.206	19.974	
260.45	22	11 -00				0.02	0.09	0.25	0.52	0.96	1.39	1.66	1.81	1.89	1.91		0.207	20.466	
249.13	23	11 -30				0.02	0.09	0.26	0.55	1.01	1.45	1.73	1.89	1.97	1.99		0.220	21.329	
238.75	24	12 -00				0.02	0.09	0.27	0.58	1.06	1.54	1.84	2.01	2.09	2.11		0.233	22.549	
229.20	25	12 -30				0.02	0.10	0.28	0.60	1.11	1.60	1.91	2.10	2.18	2.20		0.243	23.440	
220.38	26	13 -00				0.02	0.10	0.30	0.63	1.16	1.66	1.98	2.16	2.24	2.26		0.249	24.209	
212.22	27	13 -30				0.02	0.11	0.31	0.65	1.20	1.72	2.07	2.29	2.34	2.36		0.261	25.232	
204.64	28	14 -00				0.02	0.11	0.32	0.67	1.24	1.79	2.15	2.36	2.46	2.48		0.274	26.172	
197.59	29	14 -30				0.02	0.12	0.33	0.70	1.28	1.85	2.21	2.41	2.54	2.56		0.280	26.914	
191.00	30	15 -00	10	50	0.00	0.02	0.12	0.34	0.73	1.33	1.93	2.32	2.53	2.62	2.64		0.291	27.965	
179.06	32	16 -00				0.03	0.13	0.37	0.79	1.44	2.05	2.43	2.65	2.73	2.76		0.304	29.419	
168.53	34	17 -00				0.03	0.14	0.39	0.83	1.52	2.18	2.61	2.85	2.96	2.98		0.328	31.357	
159.17	36	18 -00				0.03	0.15	0.41	0.87	1.60	2.32	2.79	3.06	3.17	3.20	0.06	0.352	33.295	
150.79	38	19 -00				0.03	0.16	0.43	0.92	1.69	2.46	2.95	3.23	3.35	3.37	0.08	0.370	35.003	
143.25	40	20 -00				0.03	0.17	0.45	0.97	1.78	2.60	3.13	3.43	3.57	3.59		0.394	36.922	
127.33	45	22 -30				0.04	0.18	0.51	1.10	2.03	2.92	3.50	3.83	3.98	4.00		0.437	40.877	
114.60	50	25 -00				0.04	0.21	0.58	1.24	2.27	3.42	3.93	4.29	4.46	4.50		0.489	45.453	
104.18	55	27 -30				0.05	0.23	0.65	1.38	2.53	3.62	4.34	4.74	4.93	4.96		0.538	49.323	
95.50	60	30 -00	10	50	0.00	0.05	0.25	0.71	1.51	2.77	4.00	4.79	5.24	5.45	5.50	0.08	0.592	53.541	100 Ft. Spiral
286.50	20	15°-00′	15	75	0.00	0.02	0.08	0.23	0.48	0.88	1.29	1.54	1.67	1.75	1.77	0.06	0.195	28.482	
272.86	21	15 -45				0.02	0.09	0.24	0.50	0.92	1.35	1.63	1.78	1.84	1.86		0.206	29.961	
260.45	22	16 -30				0.02	0.09	0.25	0.52	0.96	1.39	1.66	1.81	1.89	1.91		0.207	30.699	
249.13	23	17 -15				0.02	0.09	0.26	0.55	1.01	1.45	1.73	1.89	1.97	1.99		0.220	31.994	
238.75	24	18 -00				0.02	0.09	0.27	0.58	1.06	1.54	1.84	2.01	2.09	2.11		0.233	33.824	
229.20	25	18 -45				0.02	0.10	0.28	0.60	1.11	1.60	1.91	2.10	2.18	2.20		0.243	35.160	
220.38	26	19 -30				0.02	0.10	0.30	0.63	1.16	1.66	1.98	2.16	2.24	2.26		0.249	36.314	
212.22	27	20 -15				0.02	0.11	0.31	0.65	1.20	1.72	2.07	2.29	2.34	2.36		0.261	37.848	
204.64	28	21 -00				0.02	0.11	0.32	0.67	1.24	1.79	2.15	2.36	2.46	2.48		0.274	39.258	
197.59	29	21 -45				0.02	0.12	0.33	0.70	1.28	1.85	2.21	2.41	2.54	2.56		0.280	40.371	
191.00	30	22 -30	15	75	0.00	0.02	0.12	0.34	0.73	1.33	1.93	2.32	2.53	2.62	2.64		0.291	41.948	
179.06	32	24 -00				0.03	0.13	0.37	0.79	1.44	2.05	2.43	2.65	2.73	2.76		0.304	44.129	
168.53	34	25 -30				0.03	0.14	0.39	0.83	1.52	2.18	2.61	2.85	2.95	2.98		0.328	47.036	
159.17	36	27 -00				0.03	0.15	0.41	0.87	1.60	2.32	2.79	3.06	3.17	3.20	0.06	0.352	49.943	
150.79	38	28 -30				0.03	0.16	0.43	0.92	1.69	2.46	2.95	3.23	3.35	3.37	0.08	0.370	52.505	
143.25	40	30 -00				0.03	0.17	0.45	0.97	1.78	2.60	3.13	3.43	3.57	3.59		0.394	55.383	
127.33	45	33 -45				0.04	0.18	0.51	1.10	2.03	2.92	3.50	3.83	3.98	4.00		0.437	61.316	
114.60	50	37 -30				0.04	0.21	0.58	1.24	2.27	3.42	3.93	4.29	4.46	4.50		0.489	68.230	
104.18	55	41 -15				0.05	0.23	0.65	1.38	2.53	3.62	4.34	4.74	4.93	4.96		0.538	73.985	
95.50	60	45 -00	15	75	0.00	0.05	0.25	0.71	1.51	2.77	4.00	4.79	5.24	5.45	5.50	0.08	0.592	80.312	150 Ft. Spiral

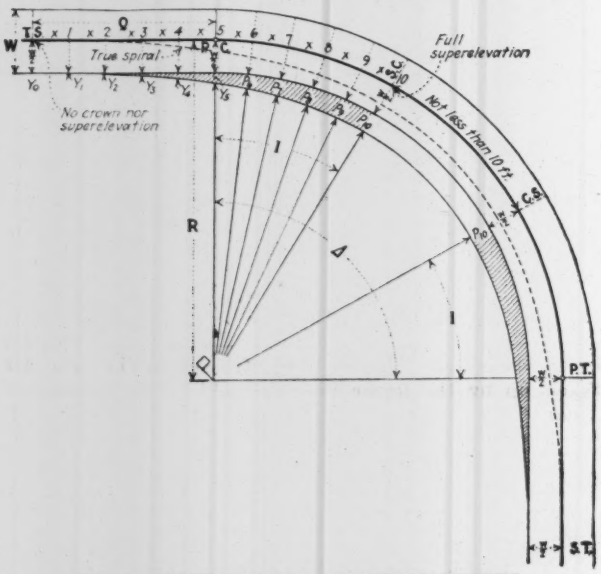


FIG. 3—DIAGRAM FOR COMPUTING CURVES FROM TABLE II

Thickness—The thickness of the one slope roadway shall be uniform and equal to the average thickness of the standard crown section.

Rate of Superelevation—The rate of superelevation for each curve in the tables is in feet rather than in inches, so that it may be used direct in figuring elevations. Curves from 7 to 14 deg. inclusive are to be superelevated at the rate of 0.04 ft. per foot—from 15 to 19 deg. inclusive, at the rate of 0.06 ft. per foot. They are to be figured in identically the same manner as the widened curves but are laid out as a simple curve with constant width. Perpendicular lines from any point on the tangent or radial lines from any point on the curve may be found without an instrument by striking arcs with a tape and stick from the two adjacent points and sighting to this intersection. "r" of course being greater than the distance between points. (See sketch Fig. 3.)

The resident engineer will take care of the breaks in grades of the outside and inside edges of the pavement opposite points 0 and 10 by vertical curves which may usually be put in by eye.

Where a spiral is 100 ft. or longer and the grade less than 2 per cent, to avoid drainage difficulties the pavement may be revolved about the inside edge.

In making original location, preference should be given to the curves of Table II. Where other curves are necessary, choose the spiral of the nearest curve.

The resident engineer will set slope stakes to include the increased volumes due to widening of all curves.

obtaining superelevations. Two are specified for the North Carolina spiral:

(1) Revolving on the original center line. This holds the original grade line and practically balances quantities including shrinkage. On the coastal plains it gets us into drainage trouble as the inside edge dips below the general level of the country.

(2) Revolving on the inside edge. This method is used on grades below 2 per cent to avoid the drainage difficulties mentioned above. It shifts the original grade line and thus complicates figures on final estimates. If used on heavy grades this method would make a prohibitive grade on the outside edge of a 50-ft. spiral.

New Type of Canal Lock Gate Developed in Sweden

Floating Sector Gates for Use in Tidal Canal Where Difference in Head Is Small—Filling Water Admitted Around Gates

By Lars Lawski

First Engineer of the Royal Board of Waterfalls and Canals, Stockholm, Sweden

TO MEET the peculiar conditions which exist in the Sodertalje Canal, at Sodertalje, near Stockholm, Sweden, a canal gate of a floating sector type has been developed. Sodertalje Canal connects Lake Malaren with the Baltic Sea. The mean water level of the lake is 1.3 ft. above the level of the Baltic at normal times, but at times of flood this difference increases to 5.6 ft. On the other hand, for five weeks in the year the lake level is as much as 1.3 ft. below the level of the Baltic. Consequently, although the lock gates have to resist only a small head, this head reverses at least once during each year. The gates have to pass a large amount of water during the spring flood and are designed so that they can be closed in running water.

Plans for the reconstructed canal call for a depth of water over the sills of 24.6 ft. at low water, a gate height of 32 ft. and a gate opening of 65 ft.

After the numerous types of ordinary lock gate had been studied, it was decided that none of them would satisfy the requirements of this particular case. Attention was directed, therefore, to the development of a new type. Some form of sector gate seemed to be the most desirable. Models of such gates were made to a scale of 1 to 25 (see Fig. 1) and tested to determine the proper angles for the gate framing and for the sides of the openings. These studies indicated that the angle *a* should be 70 deg., the angle *c*, 90 deg., and angles *e*, *f*, and *g* should be alike and equal to 20 deg. The studies also indicated that the setback of the inclined faces, *d*, should be somewhat greater than the travel of the edges *m* and *n* before the lock chamber fills at the greatest difference in water level.

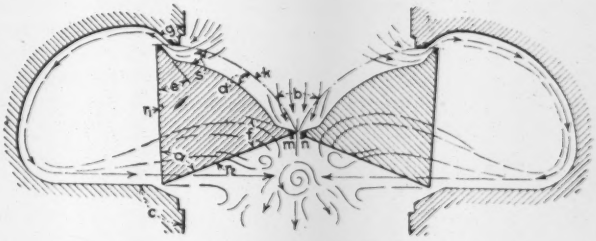


FIG. 1—DIAGRAM OF THE LOCK GATES

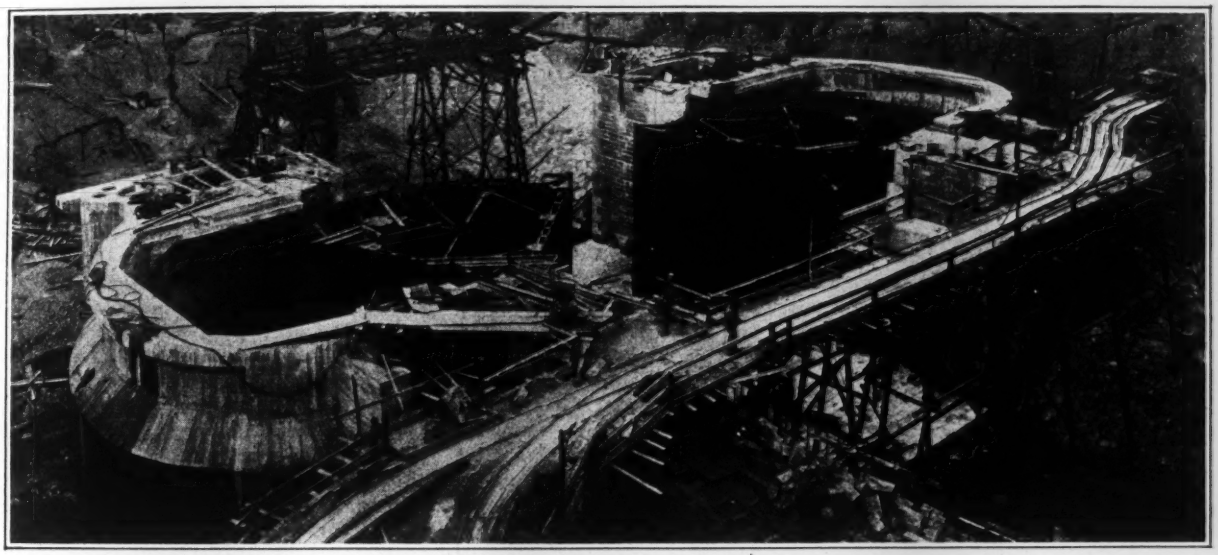


FIG. 2—LOCK GATE AND GATE NICHES
Showing air chambers at the back of the gate faces.

The full-scale gates were designed on the basis of these studies. They have a vertical turning axis with one bearing at the top and one at the bottom of the hinge to transmit the thrust of the gate to the masonry walls of the lock. As the principal face of the gate is cylindrical about the axis of turning, the resultants of either stresses of tension or compression pass through this axis and the gate is in equilibrium in all positions. The dead weight of the gate in water is counterbalanced by an air tank in the front of the gate. This arrangement leaves only a small part of the load to be carried by the bearings. The vertical stresses in the gate are taken up by the lower bearing, which is spherical in form. The upper bearing has a wedge-shaped flexible connection to the gate, shown in Fig. 2, which can be used to correct the position of the gate in case of settlement of the canal walls. This wedge can be withdrawn in order to raise the gate slightly in case foreign substances become jammed under the edge of the gate.

An advantage which this gate has over other types is that no special filling sluices are necessary and

consequently the operating machinery is less, there being no sluice gates to be opened or closed at each operation. Filling and emptying can also be carried on much more quickly than with gates having filling sluices. Consequently the capacity of the canal is considerably increased. Moreover, the security in working is greater as the gate can be operated in running water.

The advantage to be gained by filling a canal lock by

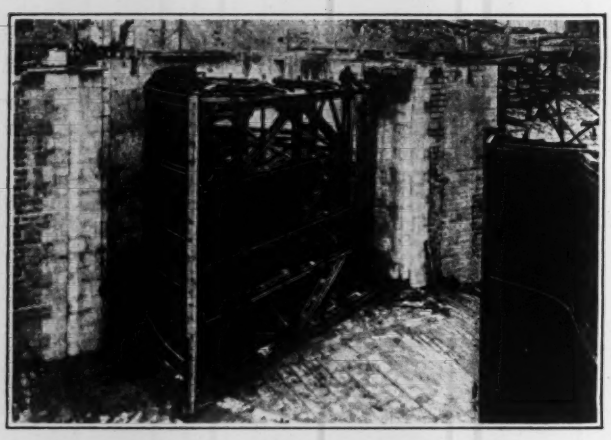


FIG. 3—FRAMEWORK AND HINGES OF ONE GATE
Showing the wedge adjustment at the upper hinge.

letting water in through the gate niches is that the two streams of water entering from opposite sides of the canal are practically perpendicular to each other where they meet at the back of the gate, thus effectually lessening the force of the flow on boats in the lock.

Two flexible cables from motor operated drums situated in recesses at the outer edge of the gate niche are used to open and close the gates.

A more detailed description of the Sodertalje Canal Locks was presented at the thirteenth International Congress of Navigation in London in 1923.

Rainfall at San Francisco for 73 Years

Annual rainfall at San Francisco for the 73 years ending with 1923 averaged 22.22 in. The annual range was from 38.82 in 1844 to 9 in. in 1917. There were eight years of the period with total rainfalls of 35 and over and two with rainfalls of less than 10 in., the latter being the year 1917 already mentioned as having a rainfall of 9 in. and the year 1898 in which the total precipitation was 9.31. The average seasonal rainfall was 22.42, or 0.2 higher than the annual average. The seasonal range was from 7.42 for the year ending June 30, 1853, to 45.85 for 1889-90. There were two years of a seasonal rainfall of less than 10 in. and ten of a rainfall in excess of 30 in. The monthly seasonal figures, which so far as here cited included an additional year, show that the driest months were July and August. The average rainfall for those months was only 0.02. July was rainless in 33 years and showed only a trace of rain in 13 years additional, out of the 74 years, while the corresponding figures for August were 38 and 15 years. January and December were the months of highest average precipitation, the figure reaching 4.81 for January and 4.54 for February. The foregoing figures have been taken from a one-page table printed in the annual report of the Spring Valley Water Co. for the year 1923, based on records of the United States Weather Bureau.

Increase Sewage Screen Capacity at Long Beach, Calif

Two Dorrco Screens to be Added to Riensch-Wurl Unit—New Pump and Reconstruction of Incinerator Planned

WHEN THE Riensch-Wurl sewage screen was installed at Long Beach, Calif., in 1916 the city had a population of about 35,000 and the plant, served by a 48-in. outfall sewer, was designed to handle a maximum of about 3½ m.g.d., the estimated flow from a tributary population of 50,000. Since that time the city has grown rapidly and for several years the amount of sewage has exceeded the maximum capacity of the plant, the excess being bypassed directly into the ocean. The screen has been in continuous operation, handling, in recent months, about 8 m.g.d. and delivering an average of 165.1 cu.ft. of screenings per 24 hours.

In March of 1923 the screening plant was shut down and thoroughly reconditioned, and a drum screen was installed in the influent channel ahead of the old screen. The drum screen was not a success and it is now planned to install new equipment to bring the capacity up to an amount sufficient to meet the present needs and, in general, to put the plant on a substantial operating basis. The original installation was described in *Engineering Record*, May 20, 1916, p. 664, and in *Engineering News*, May 4, 1916, p. 836.

The selection of the drum screen installed last year is now believed to have been ill-advised, as it did not prove to be adapted to the needs of this plant. It was 8x6 ft. in size, was driven by a 5-hp. motor at a peripheral speed of 345 ft. per minute and had one end closed, the other being open to a bypass leading to a pump sump. (In this plant all the sewage has to be pumped during high tide, the pumps operating about one-third the time.)

There was difficulty with this new screen from the start due to leakage of the sewage around the closed end and underneath it. There was no cascading action on the screen and the amount of water bypassed to the pump sump was almost negligible. After eight days of operation the screen plates (No. 16 Stubs gage) gave way, the metal tearing in several places. The slots were ⅛x½ in. in size and as there was a scant ⅛ in. of metal between slots the plates did not seem to have sufficient mechanical strength. The plates would have had longer life, in the opinion of the Long Beach engineering department, if there had not been so many slots per square foot and if these slots had been staggered instead of being placed in uniform rows. These screen plates were taken off Jan. 1, 1924. Since that time the screen frame has not been operated, nor has it been removed from the influent channel.

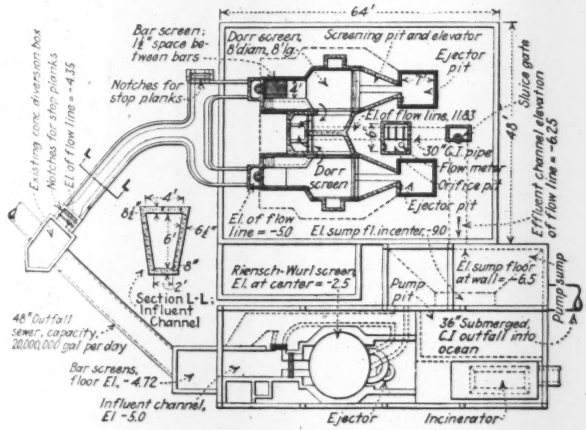
During the period of shutdown last year the following replacements were made on the Riensch-Wurl screen: Renewal of spider base, supports and gear shaft bearings, 10x3-in. intermediate cut gear, new brush trough, complete set of brushes, reinforced-concrete pier for lower bearing, main shaft sections trued up, set of new platform plates, set of new cone plates, new main segment gear complete, new 8x3-in. intermediate cut gear, brush spider overhauled, and a new 5-in. bevel cut gear.

In the six months that the Riensch-Wurl screen has been operated with the new plates, an increase in the area of the slots has occurred which is believed to be as

much as 20 per cent. This may be partly due to the wear resulting from the considerable amount of sand in the sewage brought in from showers in surf bathing houses, etc., but at least in part is ascribed to the wear of the brushes on the plates. This is the second time these plates have been renewed since the plant was built. Under Long Beach conditions it is believed that to maintain efficient operation screen plates of this sort must be renewed every 1½ to 2 years.

While the plant was shut down two 12x6-in. vertical bottom-suction open-impeller Byron Jackson sewage pumps were also installed, these having a rated capacity of 3,500 g.p.m. with a speed of 575 r.p.m. Each of these pumps is driven by a 25-hp. motor. A 1,000-g.p.m. and a 1,500-g.p.m. Dolier pump were removed, leaving of the old equipment one 1,000-g.p.m. Dolier pump.

Since the failure of the drum screen put in last fall and the continued rapid increase in population of the city, it has become apparent that a prompt increase in sewage-works capacity is necessary. Decision has been made to install two 10-m.g.d. Dorrco drum screens with ⅛x2-in. slotted plates; these new screens will normally handle the entire flow, the old Riensch-Wurl screen being kept in reserve. The new screens will be housed in a new 48x64-ft. Truscon standard building just east of the old plant, this type of structure being selected so it can be moved if the proposed harbor development should make it necessary to move the screening plant to a new location. It is also planned to install a 7,200-g.p.m. vertical centrifugal sewage pump which will bring the pumping capacity of the plant up to 14,200 g.p.m. which is believed to be sufficient to handle the sewage from a tributary population of about 200,000. The new screening

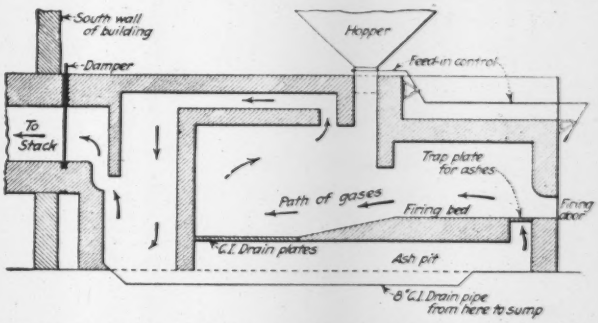

64'
Bar screen; 1" space between bars
Dorr screen, 8' diam., 8' long
Screening pit and elevator
Ejector pit
Notches for stop planks
El. of flow line, 1183
Sluice gate
Existing conc. diversion box
El. of flow line = +4.35
30" C.I. pipe
Flow meter
Orifice pit
Dorr screen
Ejector pit
El. of flow line = -5.0
El. sump fl. in center, -9.0
Effluent channel elevation of flow line = -6.25
Riensch-Wurl screen El. at center = -2.5
Pump pit
El. sump floor at wall = -6.5
Pump sump
Section L-L; Influent Channel
36" Submerged C.I. outfall into ocean
48" Outfall sewer, capacity, 20,000,000 gal per day
Bar screens, floor El. -4.72
Influent channel, El -5.0
Ejector
Incinerator

PLAN OF RECONSTRUCTED SEWAGE SCREENING PLANT AT LONG BEACH

plant will discharge into the ocean through the same outfall that has been used since the plant was built.

At present screenings are being buried in the sand just outside the screening plant without any noticeable odor or fly nuisance. However, as the cost of incineration is low (the cost of the natural gas which is used as fuel being about 3c. per 100 cu.ft. of screenings) the incinerator has been rebuilt to give more efficient combustion and all screenings are to be burned. The change in the incinerator included remodeling its interior construction, the installation of a pyrometer, CO_2 electrical machine and a scale for weighing screenings. Vitrefax refractory bricks and Sil-o-Cel insulation were used. Provision will also be made for heating the air supply for combustion, utilizing waste heat. The operating force in the incinerator will remain unchanged, i.e., one man on each of three 8-hr. shifts plus a superintendent and a relief operator whose regular work will be to aid in the general maintenance of the plant; five men in all.

In the new screening plant the screens will be 10 ft.



LONGITUDINAL SECTION OF REMODELED INCINERATOR

below the floor, with elevators raising the screenings to air-operated ejectors located at about floor level. These ejectors, similar to those in operation at the Hyperion plant of the Los Angeles system, will deliver through a 6-in. cast-iron pipe to a hopper over the firebox of the incinerator. The hopper will have a capacity of about 250 cu.ft. and will be provided with a heavy hanging baffle against which incoming screenings will be blown.

The reconstruction and operation of the sewage-works at Long Beach is in charge of Clyde F. Smith, sanitary engineer for the city.

Presentation of Papers Before Societies

ENGINEERS WHO write papers for presentation before the Western Society of Engineers this year will receive suggestions as to the presentation which if heeded will greatly enhance the value of the paper presented, conserve the time of those in the audience, add to their interest and make for an appreciative reception of the paper. Last year the society held 36 meetings attended by more than 6,000 persons. Careful presentation is as necessary to the engineer, so the society holds, as to the lawyer or the salesman, if the speaker is to have the audience feel that the meeting has been a good one. The following points are emphasized:

1. Prepare the paper carefully. Use good English and get somebody to read it and suggest corrections.
2. Rehearse the presentation by yourself. Rather than follow the manuscript in full detail, the paper may well be presented by abstract and supplemented by lantern slides. Point out the results and conclusions and emphasize the important points. Plan your presentation to take less time than has been allotted to you. Go over the paper several times so as to be familiar with the contents.
3. When presenting the paper, face the audience squarely. Talk to it, not to your manuscript. Avoid haste; also avoid dragging or the appearance of being bored. Be alive. Look and act as if you were interested in your subject and feel that it is vital that your audience should get your message.
4. In the presentation, use statistics sparingly and avoid complicated diagrams. Your audience cannot follow them. All technical terms, with the possible exception of the most elementary, should be fully explained for the benefit of those in the audience who may not be as familiar with the subject as you are. If you use lantern slides, see that they are arranged in proper order and have the place where they are to be used marked in your manuscript or insert prints of the illustrations. When talking about the slides, face the audience. Do not talk to the screen.

One of a Series of Articles on the Details of Design and Layout of Different Types of Industrial Buildings

Cold-Storage and Terminal Warehouse at Cincinnati

Seven-Story Concrete Building, Flat-Slab Type—Twin Columns and Girders for Isolating Cold-Storage Section—Cement Floor Finish—Cork Insulation—Dry Pipe Sprinklers—Tracks on First Floor

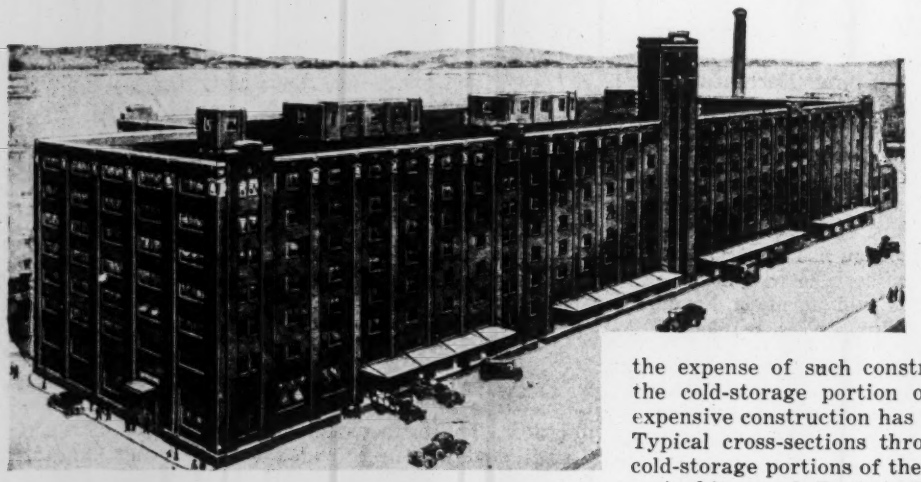


FIG. 1—ARCHITECTS' PERSPECTIVE OF BUILDING

ONE OF the latest of the large warehouse and storage buildings which are being provided in many cities is a seven-story reinforced-concrete structure at Cincinnati, Ohio, for the Cincinnati Terminal Warehouse Co. Besides being used for general storage it has accommodation for the handling of perishable freight and extensive cold-storage facilities for perishable freight, furs and other goods. Large and small space may be rented, partitions which are independent of the structural frame being built to suit the various tenants. Two tracks within the building provide for receiving and forwarding rail shipments direct, while the whole of one side of the first floor is arranged for wagon service. There is a total floor area of 800,000 sq.ft.; the cubic content of the building is 9,000,000 cu.ft.

This building, shown in Fig. 1, is 613x175½ ft. in plan, extending from Central Ave. nearly to Smith St. and having its main front, with team doorways, on Augusta St. For convenience in handling freight the first floor is about 4 ft. above the tracks and street, or practically level with the floors of cars and wagons. From the general plan, Fig. 2, it will be seen that the two interior tracks are at the rear, with a combined length of 1,000 ft., and are separated by a platform. Both tracks are spurs from railroads in Front St., at the rear of the building; one is a stub track and the other extends through the farther end of the building to a track connection in Smith St. No basement is provided, as it would be below the flood level of the Ohio River, which is only a short distance from Front St. The interior tracks, therefore, are of the ordinary ballasted type and laid on the graded surface of the ground.

It will be noted from the plan that a corner of the building is cut off to give room for the approach curves of the tracks. In some warehouses, as in that at Duluth (*Engineering News-Record*, Feb. 21, 1924, p. 324), a special arrangement of columns to accommodate the tracks is provided in the first story, carrying heavy framing in the second floor to support the typical column spacing above. In the Cincinnati case, however, it was considered that the amount of additional floor space thus secured would not warrant the expense of such construction. In fact, except for the cold-storage portion of the building, special and expensive construction has been almost entirely avoided. Typical cross-sections through the warehouse and the cold-storage portions of the building are given in Fig. 3.

Architectural Design—Special attention was given by the designers to the architectural results economically possible in warehouse design. It was found that with a slight additional expenditure the exterior could be made of attractive appearance by creating breaks in the long wall surfaces to form a series of pylons, while the main feature is a concrete and brick tower in the center in which are located the tanks for gravity supply of the sprinkler system (Fig. 1). This tower, 22x44 ft., is about 136 ft. high or 45 ft. above the roof of the main building. It is considered that the effect obtained by this composition, together with the use of buff face-brick, has proved that the effort to secure a pleasing design was worth while.

Column Spacing and Foundations—To meet the conditions of size of site, a general column spacing was adopted of 20 ft. 3½ in. c. to c. longitudinally and 19 ft. 7½ in. transversely, the only variation in the former being two end spans of 22 ft. to fill out the length. Owing to the interior tracks, however, the transverse spacing is more irregular; thus there are two track spans of 26 ft. 9 in. and 25 ft. 11 in. while the front span of 23 ft. gives additional space for handling freight near the doorways. In the first story the height is 18 ft., to give the necessary clearance for freight cars and to secure good light and ventilation; in the other stories the height is 11 ft. from floor to floor.

Concrete piles of the cast-in-place type form the foundations and are mainly 35 ft. long, which was the maximum depth that could be obtained by this method under the local conditions. They are in soft clay and old filled material, a considerable amount of old stone foundation work having to be removed before their construction could be started. Their bearing power was determined by the *Engineering News* formula and in most cases the desired safe load of 30 tons per pile was obtained. Additional piles were driven where any serious deficiency occurred. All piles were 8 and 22 in. in diameter at top and bottom respectively. At first

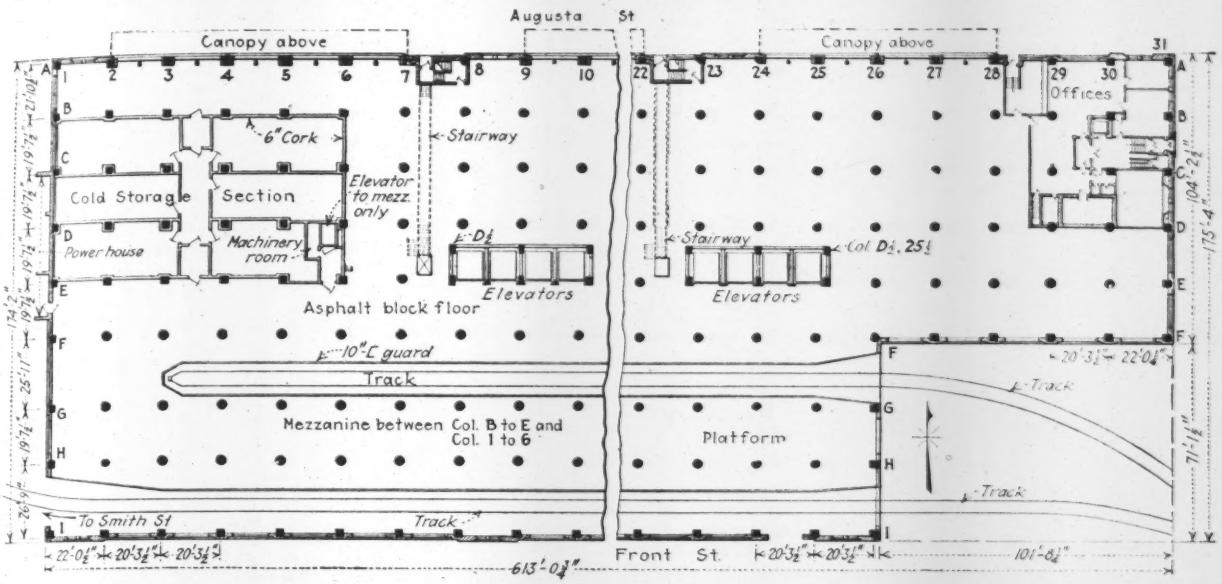


FIG. 2—FIRST FLOOR PLAN, WITH TRACKS AND COLD ROOMS

the mandrels for the pile holes were driven at a spacing of 30 in. c. to c., but as this caused a tendency to crush or deform and lift piles already in place, this spacing was increased to 36 in. in general and 33 in. in some places.

Interior columns are mainly of cylindrical section with flaring caps, those of the first floor having a diameter of 4½ ft. for the standard bays and 5½ ft. for the railroad bays. In the cold-storage section, however, the columns are square, this shape being considered more convenient for the application of the insulating lining. All exterior or wall columns are of rectangular section with brackets. Since each floor slab in the cold-storage section is separated from the adjacent floor of the main part of the building, a double row of columns is required to support the slabs at this open joint, as shown by Figs. 4 and 5. The effects of an explosion at one of the columns was described in *Engineering News-Record* of June 5, 1924, p. 987.

Floor Slabs and Flooring—Floor construction is of the flat-slab type, with two-way reinforcement, designed for a live-load of 250 lb. per square foot. The slab thickness varies from 8 to 11 in., including cement finish. With the variation in column spacing and length of span several changes in thickness of slab were necessary to meet the requirements of economy and dead-weight. These changes are made by sloping the forms between adjacent drop panels, instead of by sharp breaks in the slab thickness. Drop panels are used on interior columns only. The roof, which is of construction similar to that of the floors, is covered with asphalt and gravel roofing, except that special construction is used over the cold-storage part of the building.

Beams around openings and under fire walls are of wide and shallow section, having the same depth as the drop panels (Fig. 4). This arrangement was adopted to avoid the cutting of the steel forms of the column caps to admit deep beams. In the first floor, the slab rests on rows of concrete beams about 10 ft. apart,

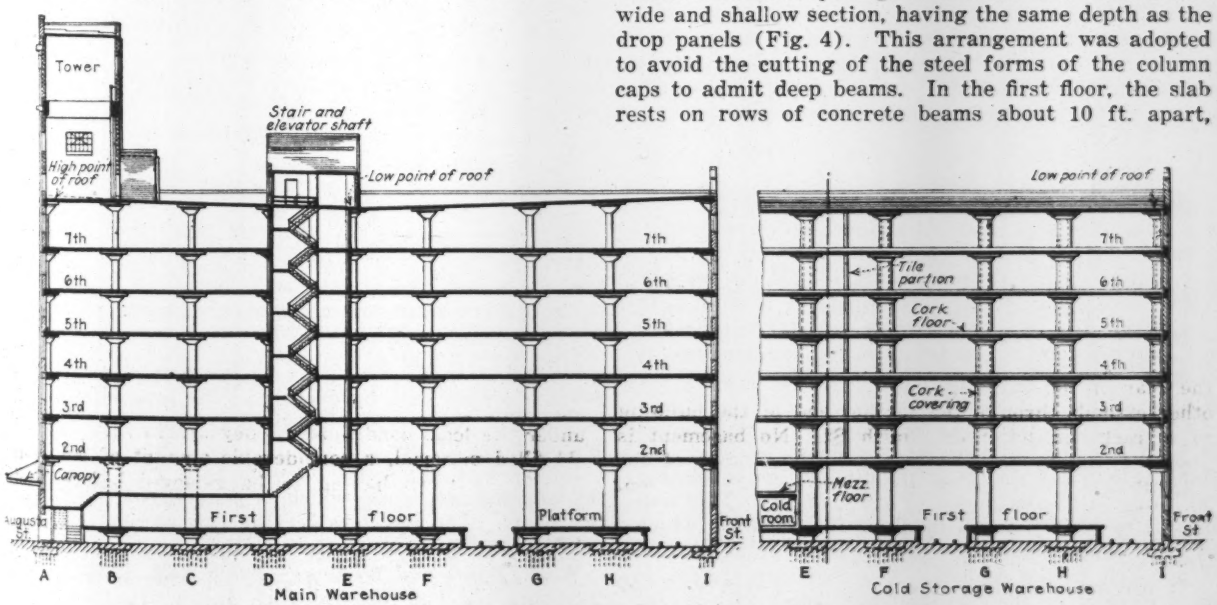


FIG. 3—TYPICAL CROSS-SECTIONS OF WAREHOUSE

carried by short struts which are seated on the footings. The walls of the first story are also carried on beams which rest on the column footings, so that all parts of the structure are supported on the pile foundations.

Asphalt block flooring is used on the first floor and also in front of the elevators on the upper floors, on ac-

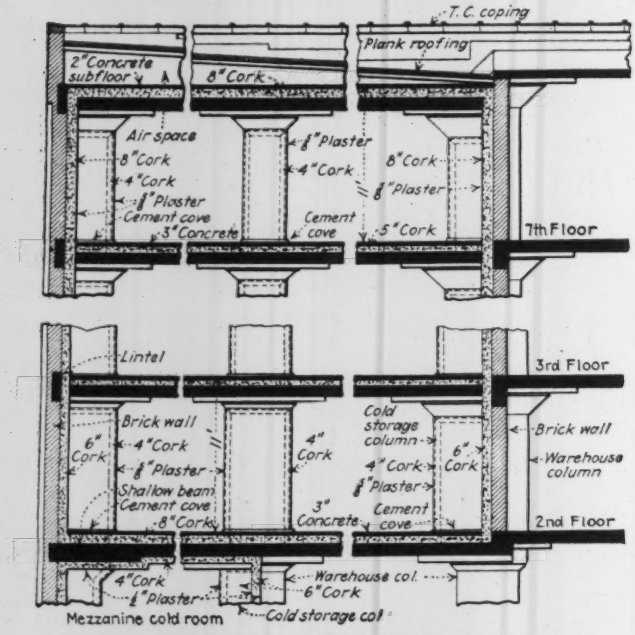


FIG. 4—INSULATION OF COLD-STORAGE ROOMS
Cork floor 8 in. thick on second and sixth floors; 6 in. on fourth; 5 in. on fifth and seventh; 4 in. on third floor.

count of the heavy trucking and the facility of repair or renewal. These blocks are 4x8 in. and 1¼ in. thick, laid on a ½-in. coat of cement mortar on the concrete slab. On all other parts the floors have a 1-in. cement finish of 1:2 mix, made with stone having a maximum size of ¼ in. This finishing course is applied the day after the concrete has been poured for the slab, and is at once floated with a wood float and covered with tar paper to check rapid evaporation. After this finish has thoroughly set and the shores for the floor above have been removed, the surface is ground with electrically operated surfacing machines, which rub in a thin grout of cement and powdered carborundum which has passed a No. 80 sieve. Finally, when dry, the surface is coated with a liquid floor hardener.

Cold-Storage Section—Special construction is employed for this part of the building, which comprises an area 103x175½ ft. in each upper story. In the first story, however, this section is only 103x59 ft., because of the space required for unloading and loading cars and trucks. The total cold-storage capacity is 1,500,000 cu.ft., but this section is designed for the addition of two more stories to increase this capacity to 2,000,000 cu.ft.

In this part of the building double or twin columns are used for the exterior, as the floor slab does not extend into the walls, thus permitting the insulating wall lining to be continuous (Figs. 4 and 5). This wall lining is of cork, 8 and 6 in. thick for rooms in which different temperatures are maintained. It is secured by laying it in hot asphalt. A ½-in. plaster facing is placed directly on the cork and is finished with a coat of kalsomine.

For insulating the floors, a 5- or 8-in. cork layer is laid in hot asphalt on the concrete slab and covered with a 3-in. concrete floor, the surface of which is finished in the manner already described. To provide for this floor covering, the slabs in the cold-storage section are below those of the adjacent floors, so that the finish surfaces are level throughout the building. All columns are sheathed with 4-in. cork and ½-in. plaster. To permit cleaning the floors easily, a cement curb or cove is laid around the wall and around each column (Fig. 5). This cove is separate from the 3-in. concrete floor, being laid in a groove in the latter, and its upstanding leg is of such width as to project beyond the plaster finish of vertical surfaces.

The roof slab over the top floor has 8 in. of cork with a 2-in. concrete covering, above which is an air space beneath a sloping roof of plank with asphalt and gravel roofing. Cork lining for the ceilings is employed only in the first story, where a 4-in. lining with ½-in. plaster finish is required to prevent the freezing of goods in contact with the floor above. The mechanical equipment for the cold-storage section is installed in the power house, noted below.

Six cold rooms are provided on the first floor for temporary storage at about 35 deg. F. The mezzanine space above this is arranged for fish storage at zero; the cooling coils in this space are placed on the walls on account of the low head room. In the second and third floors, arranged for the storage of eggs or other goods requiring a moderate temperature of about 29 deg. F., the cooling is effected by mechanical air circulation over brine-cooled bunker coils at the end of the room. The space on the fourth and fifth floors, designed for interchangeable use, is equipped with bunkers and circulating apparatus similar to the floors below, and in addition is provided with overhead coils. When used for moderate-temperature storage, the bunker coils only will be used. For sharp freezing both systems will be used, and for holding temperatures, the overhead coils

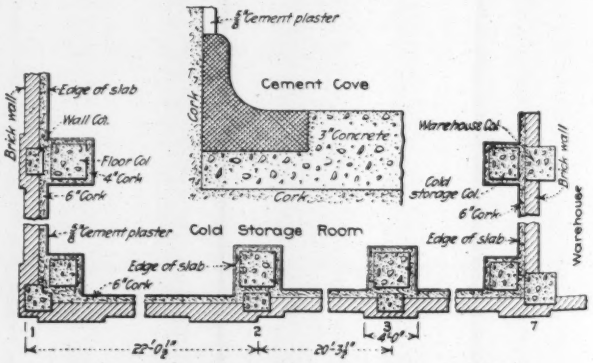


FIG. 5—DOUBLE-COLUMN ARRANGEMENT, COLD-STORAGE SECTION

alone will be used. The space on the sixth and seventh floors is cooled only by overhead coils proportioned to maintain a temperature of 10 deg. below zero under ordinary conditions.

Double-door vestibules on each floor give access to the cold-storage space, which is generally divided into two parts. The elevators serving this section are outside, in the general storage section.

Walls, Doors and Windows—Brick walls 13 in. thick, including the buff pressed-brick facing trimmed with stone and terra cotta, are used for the exterior, and a

13-in. brick wall separates the cold-storage section from the main portion. These walls are carried by concrete lintel beams. All stories above the first are subdivided by 13-in. brick fire walls; while 9-in. brick walls enclose the elevator shafts. Other interior partitions, which may be arranged to suit the requirements of tenants, are of smooth-faced unplastered terra-cotta tile. The offices of the warehouse company are on the first floor and offices for tenants are provided on the upper floors on the Central Ave. front. Hollow tile is used for the office partitions and for the foreman's room on the first floor.

Steel factory sash is used throughout, but with plain glass, as the outside fire hazard is not great. Hand-operated pivoted panels provide for ventilation. All exterior doors are of wood, including the horizontally folding doors along the wagon platform on the Augusta St. side. These doors are 10 ft. wide and 7 ft. 8 in. high, with fixed transoms above them. Track entrances have rolling steel doors. Automatic rolling steel doors and safety gates are provided at the elevator openings. Doorways in the fire walls have automatic sliding tin-clad doors on both sides of the wall. A steel and concrete canopy protects the handling of goods at the doorways along the Augusta St. side.

Elevators—For handling freight, there are eleven electric elevators in three banks. Ten of these are of 3-ton capacity with platforms 9x11 ft.; the other is a 6-ton elevator 11x22 ft., having two side doors similar to the single door of each 3-ton elevator, and also an end door for the loading of long material. All these elevators operate at a speed of 200 ft. per minute. In addition there is a passenger elevator in the office section and a sidewalk lift type of elevator from the first floor to the fish storage room in the mezzanine floor. The passenger elevator is equipped with push-button control system in addition to the manual control. All the freight elevators have manual control.

Freight scales of 5,000 lb. capacity are provided on the first floor. Provision is made for charging electric batteries for trucks which will be used to handle freight on the first floor.

Power Plant and Fire Protection—A two-story power house 45x82 ft. and 92 ft. high is built adjacent to one end of the warehouse, with its floor 13½ ft. above street grade so as to be above the highest flood level of the Ohio River. This building is of concrete frame construction, with brick walls. In order to clear a curved track connection one corner is beveled, the corner column being diagonal. The compressor room is open to the roof and will have three 1-ton electric traveling cranes for handling the machinery. One end of the compressor room has a small mezzanine floor. A 140-ton overhead coal bin is served from a track hopper by an elevating conveyor. Besides the machinery for the cold-storage system there are two 200-kw. motor generator sets for the elevators, a fire pump of 1,000 gal. capacity per minute and a 125-hp. water-tube boiler for heating. A steel stack 110 ft. high above the grates serves the boiler.

An automatic sprinkler system installed throughout the main building for fire protection is on the dry-pipe plan, since only a small part of the building is heated. Water for this system is supplied by two 25,000-gal. tanks in the tower, to which the water is pumped from the city mains. There is also direct connection with the mains for drinking and fire purposes. In addition to serving the sprinkler system, the fire pump serves pipes having hose coils at intervals.

For the freezing or cooling service of the cold-

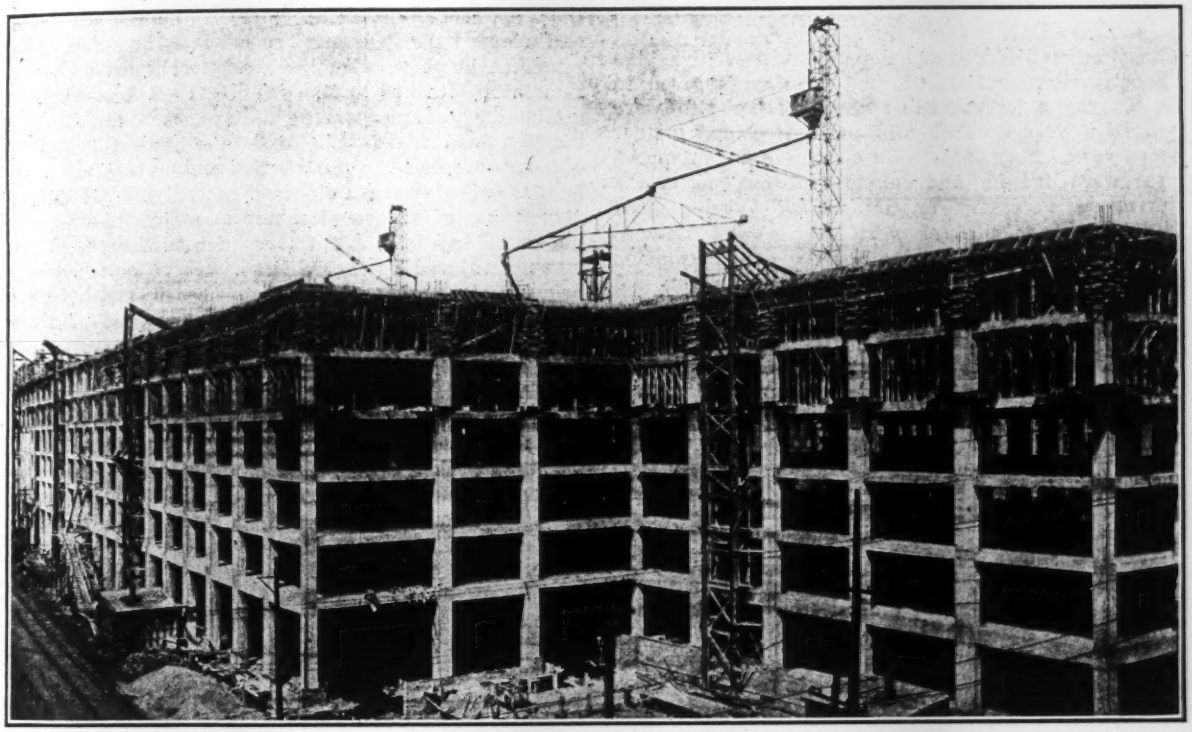


FIG. 6—CONSTRUCTION OF WAREHOUSE BUILDING AT CINCINNATI

Two large doorways in middle for tracks connecting with railroad tracks in Front St., at left. Concreting plants on north side. Four slide elevators for material on south side. Wood-working mill, steel and lumber storage in foreground.

storage section there are three 65-ton two-stage double-acting ammonia compressors, each driven at 100 r.p.m. by a motor mounted on the shaft between the two cylinders. Brine is circulated by two 600-gal. double-suction centrifugal pumps with direct-connected motors. Two 125-ton brine coolers are installed on the mezzanine floor, cooling water being supplied by wells at the power house. The condensers for the ammonia are of the atmospheric type, located on the roof.

Interior lighting is by 100-watt lamps spaced about 20 ft. apart; additional lamps under the canopy provide ample lighting at the loading doorways. All switches for the cold-storage section are within the respective vestibules and pilot lights outside indicate when any of the switches are turned on.

Construction Methods and Plant—A view of the stage of construction towards the end of May is given in Fig. 6. On a lot adjoining the building site were arranged a wood-working mill and a steel and lumber storage yard. Form panels were made in the mill. All shores were 4x4 in. and cut to uniform length, the adjustments necessary on account of varying floor thickness being obtained with blocks and wedges. Independent forms were used for the double columns and beams surrounding the cold-storage portion, and the two forms were held apart by thin wedges. Two electrically-driven portable saw tables within the building were moved from floor to floor as the work progressed. Steel forms were used for the column caps. Reinforcing steel was unloaded from cars and cut and bent in the steel yard, which was equipped with power benders and shears. Form panels and reinforcing steel were hauled to the building on two-wheeled carts and raised to the various floors on skip hoists. Four of these hoists were installed along the south side of the building, as shown.

For the concreting, two mixing and hoisting plants were located on the north side of the building, each serving about half of the building area; these are shown in Fig. 6. Sand and stone were delivered by truck and dumped into a hopper at the street level. Electrically-driven bucket conveyors elevated these materials into an overhead bin holding 65 cu.yd. of sand and 130 cu.yd. of crushed stone. From the bin the materials flowed by gravity into a measuring and charging hopper, the cement being added by hand. Concrete was elevated in a 180-ft. steel tower, with distributing chutes consisting of a boom section, a counterbalanced section, a line section supported on an A-frame, and a section supported on floor trestles. The placing of concrete averaged 300 cu.yd. per 9-hour run, with a maximum of 350 cu.yd.

Engineers and Contractors—This large storage warehouse and its equipment were designed for the Cincinnati Terminal Warehouse Co. by A. M. Allen & Co., architects and engineers, Cleveland, Ohio. The general layout was subject to the approval of William J. Hogan, who will operate the warehouse as manager for the owners. The Ferro Concrete Construction Co., Cincinnati, Ohio, had the contract for building construction. The cost of the structure with machinery and equipment complete will be about $2,400,000, of which $1,600,000 represents the cost of the main building, exclusive of insulation and equipment. Work on the foundation piling was started July 1, 1923, and it is expected to have the entire building ready for occupation by Oct. 1, 1924.

Old Fracture in Chord Web-Plate Caused Bridge Collapse

INVESTIGATION on the part of engineers of the State Highway Department of Connecticut into the collapse of a steel highway bridge at Oneco on March 14 has resulted in a finding that an old fracture of an inner web-plate of the top chord was responsible for the collapse. The bridge was of 10 tons capacity, but failed under a 3½-ton truck weighing a little over 11,000 lb.

A heavy snowstorm prevailed on the day of the accident, and there was a heavy load of snow on the bridge. When the truck was about three-fourths of the way across the bridge, one of the trusses failed and dropped the floor and the truck. The other truss remained in place, with the steel floorbeams and floor remaining attached to it.

The bridge is reported to have been designed to carry a load of 10 tons, with allowance for impact. Some reinforcement was carried out about ten years ago. Last winter a motor car in crossing the bridge struck one of the trusses, but close examination did not reveal any defects, and it is believed that the bridge was not injured by the collision. No reports had ever been received that the bridge needed repair. The trusses, floor system, wooden stringers, and planking appeared to be in excellent condition. The granite abutments also were in good condition, though the downstream side had settled about 8 in.

When the failed truss was taken from the water it was found that the inner web-plate of the top chord had been broken a long time, as evidenced by corrosion in the fracture. The inner angle of the compression diagonal also showed an old fracture. The fracture in the chord web-plate started on the bottom of the plate, running at an angle of about 30 deg., then following the gage line between two rivets, and then going up. However, the angles and cover plates showed no signs of fracture. The result of the examination is the conclusion of the engineers that "the old fracture was no doubt the cause of the collapse."

Until last July the bridge was owned and maintained by the town. Since then it has been under the jurisdiction of the State Highway Department.

Motor Cars for Boston & Maine R.R.

In announcing the decision to order two motor cars for branch line service, the 1923 annual report of the Boston & Maine R.R. asserts that "the development of satisfactory motor cars for use on branch lines has been going through an experimental stage, and the decision of the management to await the result of tests being made by other roads appears to have been justified. During the past year, experiments were continued with a steam unit car, and the management has also kept in touch with the test of various types of gasoline cars on other roads. As a result, authority has been granted for the acquisition of one heavy type motor car with trailer, and one light single unit car, both of which should be available for service during the current year. It is expected that the economies realized from the substitution of these cars for steam operation will be substantial, and there will also be an opportunity for the technical officers of the railroad to study the operating costs and performance of such cars at close range."

City and State Build Power Plant on Glommen River

Large Flood Flow and Narrow Channel Necessitate Large Control Gates—Rugged Masonry to Withstand Ice Shock

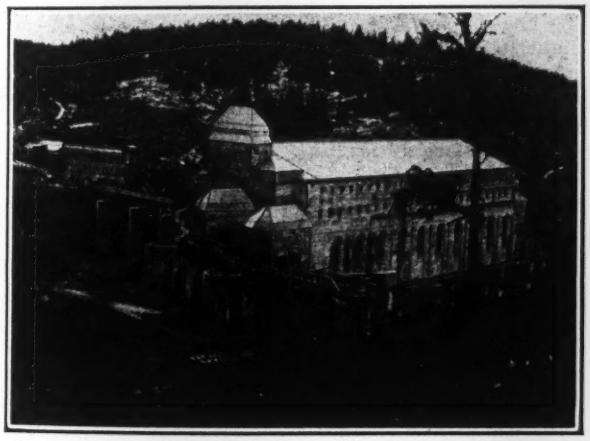
By J. B. Naumann
Kristiania, Norway

THE CITY of Kristiania and the Norwegian national government have united on the construction of a power plant to have an ultimate installed capacity of 148,500 hp. on the Glommen River, 25 miles above Kristiania, Norway. When completed the plant will be owned two-thirds by the city and one-third by the national government.

The discharge of the Glommen River exceeds that of any other river in Norway; it reaches a maximum of 100,000 sec.-ft. in spring and has a regulated minimum flow in winter of 8,500 sec.-ft. As the river valley at the site of the new power development is narrow, it was necessary to provide large crest gates to discharge the flood flow. With this object in view, the dam across the river was made in four sections, three spillway sections of gravity type concrete dam, surmounted by roller gates 66 ft. long and having a clear lift of 29 ft., and one section of gravity type dam across the main channel of the stream 150 ft. long. The three flood gates have a total capacity of 180,000 sec.-ft.

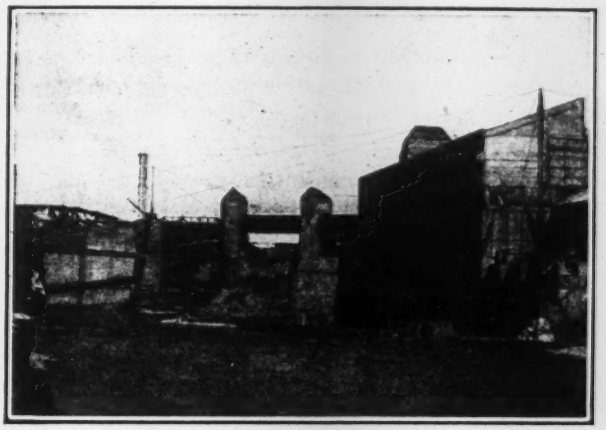
Due to the high velocity of the stream and the quantity of ice carried at times of flood, all surfaces exposed to the flow of the river are faced with granite.

The power house is built in the river bed to the right



SOLBERGFOS POWER PLANT, NORWAY
Showing intake gates at the left, piers and operating towers for the roller gates in the center foreground, and power house and tailrace right center.

of the main channel with its long dimensions parallel to the river and its upstream end in the dam. The control gates are between the upstream end of the power house and the right bank of the river, and the forebay is excavated between the back of the power house and the right bank. The substructure and superstructure are built of concrete. The substructure is built for thirteen units of a capacity of 11,500 hp. each, Francis type turbines with vertical shafts, single runner and exciter on top; with concrete scroll cases. This is the first Norwegian plant where this design has been used. The speed of the turbines is 150 r.p.m. and the head is normally 70 ft.,



DAM AND POWER HOUSE LOOKING UPSTREAM

but is decreased to 51 ft. during flood season. Each generator has a capacity of 11,000 kva. at 10,500 volts.

At the present time only seven units are being installed and the power house superstructure is being built so that three more units can be added without extending it.

As extensive logging operations take place in the river during the summer months, it was necessary to construct a log chute as a bypass to the plant. This chute is 2,300 ft. long, built of wood, partly in tunnel and partly in open cut.

In order to take care of the river during construction, which took place during the low water flow of the winter time, two tunnels were excavated through the rock around the left end of the dam. These tunnels will be sealed as soon as the dam is completed.

River and Harbor Expenditures for 1924

When Congress last year over-rode the Director of the Budget and the Committees on Appropriations and appropriated $56,589,910 in a lump sum to be expended in the discretion of the Chief of Engineers in improvements of rivers and harbors, it was predicted by opponents of that action that much of the money would be wasted on unimportant projects. Major General Harry Taylor, the Chief of Engineers, has just had made a summary of the expenditures under that appropriation, which shows that the preponderance of the appropriation was expended on the very important projects. The principal seacoast harbors received $27,503,600 of the entire amount; secondary harbors and coastwise channels, $6,888,400. Lake harbors and channels received $3,794,600. The principal rivers and their channels received $17,767,468; secondary rivers, $545,841. Administrative costs were $90,000. The principal individual allotments were as follows: New York Harbor, $10,330,900; Ohio River, $9,000,000; Mississippi above Cairo, $2,587,468; Delaware, Philadelphia to the sea, $2,000,000; Chesapeake and Delaware Canal, $1,000,000; Monongahela, $1,900,000; Missouri River, $1,200,000. The amount allotted to New York Harbor was sub-divided as follows: Entrance channels, $250,000; East River, $5,118,800; New York and New Jersey Channels, $2,700,000; Jamaica Bay, $60,000; Newark Bay, Hackensack and Passaic Rivers, $805,000; Bronx River, $330,000; Hudson River Channel, $465,000. The remainder was divided among a number of small improvements.

Hoover Committee Reports on Seasonal Construction

Means for Winter Work Well Developed—Construction in Winter Often Cheaper—Home Builders Can Help—Data Wanted

CUSTOM is mainly responsible for seasonal idleness in the construction industries according to the summary just published by the Department of Commerce of the report of the special committee appointed about a year ago by Secretary Hoover. The full report, a sizeable volume of fourteen chapters, will be published, it is expected, within two months. It presents the data on which are based the broad conclusion that climatic influences are minor as a cause of seasonal construction operations and it points out the means for changing present construction customs. Based on the full report the summary now published makes the following statement of facts and recommendations for improvement. Contrary to popular belief, bad weather is not the principal cause of variations in employment from month to month. The present survey shows that seasonal idleness is not confined to regions where climate is severe. Cities in the South and on the Pacific coast are affected much like those on the Canadian border.

It is the general rule that the building trades are occupied wholly for only three to five months in the year, and practically all the cities studied show a large percentage of idleness in these trades not only from December to March, but in other months as well. Many of the seasonal ups and downs are undoubtedly preventable. The construction industries are grappling with the problem; they now need and should have the support of the general public, for the burden of idleness falls most heavily not on the producers and distributors but on the employees and the public.

Forethought in planning new construction and repair work is necessary if a marked betterment in conditions is to be brought about. Practically any owner can now find out how to schedule his building or repairs to take advantage of the time when competent workers will probably be available and when the contractor will not have to resort to "snowballing" to obtain workers. The majority of owners do not take into consideration their own financial interest or that of the construction industries and workers in this respect. Besides scheduling their construction and repair work citizens may use their influence in modifying prevailing customs and in securing a proper scheduling of public works.

Winter Construction—With due precautions and proper equipment nearly all construction work can be carried on in winter and at no great difference in cost. The owner may often profit by saving interest on his investment and by securing earlier use of the structure. Although equipment needed for protection and artificial heat in winter construction requires some expenditure and there may be some increase in overhead on the job due to delays from winter storms, these items often may be offset by the saving in salaries and the reduction in the contractor's general overhead. Labor in general is more efficient as skilled workmen can be more easily obtained. Although relative unit costs of labor in winter and summer vary with the class of work, the cost in winter, especially under first-class management, may be actually less than at other times.

Building materials usually can be obtained at somewhat reduced prices because of the smaller demand. As the methods of handling winter work develop, and as manufacturers, supply dealers, and labor take more interest in encouraging winter construction, the cost can be appreciably reduced.

Home Builders—Home owners are the largest single class of property owners, and residential building forms the largest single class of construction. The opportunities of home owners and home builders to remedy present conditions may be taken as an example of what building owners of all classes may do.

Repair work and new construction should be classed separately for a number of reasons. Repair work of a minor character is usually paid for on a time basis; that is, the owner pays a fixed rate per hour for the services of the men engaged. When this is done during a period of inactivity in a given trade the most efficient workers are ordinarily available, and they are able to do a better job in less time than less skilled men who might perform the work during an active period.

Most home builders suffer from not having their plans and other arrangements made in advance of the time when they are ready to go ahead. But the number who consult their architect and contractor as to the best time to go ahead is increasing; and as it increases, the construction industry is able to render better service at less cost. The man who builds a house serves his own interest and the public interest by starting work at the right time. The right time usually means when other customers are not rushing into the field. Since the building of the home requires only a few months, it is not ordinarily difficult to plan the work with reference to probable labor conditions.

Bankers and Investors—It is highly important in the banker's own interest as well as in the interest of his customers that he take account of the seasonal factor. Forethought in planning ahead and use of information as to the seasonal trends will reduce interest on investment and will release investment funds for other productive uses.

Public Utilities—A heavy strain has been put upon public utilities by the single leasing date and this problem should be attacked by them in collaboration with the other interested groups. Evidence is lacking that public utilities in general authorize the erection of buildings at other times than the usual building season. They might well set up "expansion reserves" as a practical and profitable means for constructing additions during low seasonal and cyclical periods.

Public Works—Public works form about 25 per cent of all construction activities, varying in the last few years from three-quarters of a billion to over a billion dollars. They are therefore of great potential importance in stabilizing general construction activity. Out of 200 engineers in all parts of the country who replied to the committee's question, "Are public improvements rushed right along in the peaks of the annual building season?" 192 answered in the affirmative. The comment was frankly added that public works are undertaken without regard to private needs.

The need for public works can usually be foreseen well in advance. Legislators, administrative officials, and the public should unite to see:

1. That contracts for public works are let when the work can be performed economically and with the least interference with private construction.

2. That the government, whether national, state, or local, has its construction program planned ahead for several years subject to such revision as new conditions may require. This permits thorough consideration of all factors affecting the work, and helps to avoid the waste which invariably occurs when plans and financing arrangements have to be rushed through at the last moment.

3. That public officials are given funds with which to plan work when definite authorization at a future date is virtually certain.

4. That administrative officials are given latitude as to the time for awarding contracts and setting dates for their completion, so that such work can be undertaken when employment and other conditions are most favorable.

Enlisting Public Support—The different groups within the construction industries have first of all the responsibility of being prepared to take care of construction work economically throughout the year. This involves study and experiment in the execution and planning of construction under adverse weather conditions; and since so much depends on the working efficiency of men and equipment, the committee recommends that employers and engineers study the subject on the job and in conferences between representatives of employers and employees. There should be general use of modern accounting methods among contractors and the distributors of building materials. Where the contractor puts his equipment on the payroll, he can readily see the cost of seasonal idleness. Comparable records of employment, hours, and earnings must also be kept and made available to the public.

In obtaining the co-operation of building owners and the public, the committee recommends the use of personal contact, newspaper articles, advertising, and circulars. It believes that each organized group associated with the local building industry should have a definite program to which its members can rally, relating their program to the general program of other groups.

General Contractors—General contractors are in contact with more interests than any other single group within the construction industries. It is from them that much of the needed information must be drawn by the other groups, and it is to their customers who control business and industrial projects, churches, and hospitals, as well as to home builders, boards of education, and others that the contractor should turn in order to encourage building during the dull periods. Intensive selling methods, especially in smaller cities and towns, can do much in this respect.

Closer study of overhead costs by general contractors will throw additional light on their problem. The construction business is like any other merchandising business, and the successful contractor must plan for business the year round.

Winter work means additional cost in certain items, but progressive contractors have already devised methods for reducing costs and increasing profits on winter construction.

Labor—The co-operation of labor and management is necessary to increase production and to eliminate waste.

Records of employment, hours, and earnings should be systematically kept by labor as well as management, and made available to the public.

Advertising to apprise the public of dull periods in the building trades can be profitably utilized by labor.

Since the letting of contracts for new work is likely to be interfered with when there is uncertainty caused by pending wage agreements, the committee recommends that such agreements be concluded at least 60 and preferably 90 days or more before the date when they take effect.

Modern Logging Railway Practice

A COMPARISON of standard-gage and narrow-gage lines for logging work was presented at a recent meeting of the Appalachian Logging Congress, in Cincinnati, by C. S. Badgett, Canton, N. C. With the same weight of locomotive, he considered that narrow gage permits a lower construction cost, due to less grading and more flexible alignment; it has also a lower cost for ties and for maintenance. On the other hand, standard gage eliminates transfer of material and permits wider loading and the use of more flexible loading machinery. The standard gage will also enable heavier equipment to be used. Local conditions will affect the selection, as to economy of construction, operation and maintenance, but in either case the equipment should be light.

A combined system of logging by railway and cable incline was described by Leslie M. Brooks, East La Porte, N. C. A brief abstract of this is given below.

We built our standard-gage logging road as far up the stream as possible with a maximum grade of 6½ per cent. When the grade of the stream became such that a large amount of switchbacking would have been necessary, we built narrow-gage inclines with 50-lb. rails, using a maximum grade of 20 per cent and a maximum curvature of 75 deg. On one fork of the stream, by building half a mile of incline on a grade of 20 per cent, we reached a point where it was possible to use a 22-ton locomotive for 1½ miles further upstream, at which point we again made use of a second incline to load and drop the logs to the point reached by the locomotive. In some instances we have reached a distance of nearly two miles by the use of two incline machines without using a locomotive.

A two-drum skidder, with a special front drum, loaded the logs and lowered the cars down the incline. This machine was not mounted on a car but on a sled having under it two 8x8-in. crosspieces about 12 ft. apart, to which were attached flanged shoes that kept the machine on the rails. We found that there was much less danger of the machine turning over while moving in this way than if it was placed on a car. We attached an ordinary stiff boom to this machine, using the top drum as a loading drum. We also skidded logs out of rough ground a distance of four or five hundred feet from the track with this machine.

Our practice was to start this machine at the bottom of the incline, loading and lowering the logs as we proceeded up the incline until we reached a point about one mile from the bottom. There we set out the first machine, put in a switch and started a second machine upward from this point, using the first machine merely to drop the loads and pull back the empties. This increased the output of our incline by 50 per cent over what one machine could do, for while the first machine was dropping the loads and pulling the smpties back the second machine was loading. We used ¾-in. steel rope on our incline drum, operating narrow-gage skeleton logging cars, weighing about 7,000 lb. each and carrying about 1,500 ft. of logs each, handling two cars at a trip.

Dalton G. Miller Is Correct Name

In the July 10 issue of *Engineering News-Record*, page 67, in the paper on "Concrete Behavior in Sulphate Solutions" in the abstracts from the meeting of the American Society for Testing Materials, the name of Dalton G. Miller, senior drainage engineer of the United States Department of Agriculture, was given in error as Norton G. Miller.

Rerolled Reinforcement Strong But Not Ductile

Tests of New and Rerolled Bars Made at University of Wisconsin—Suggested Improvements in Rerolled Material

BY J. B. KOMMERS

Associate Professor of Mechanics, University of Wisconsin, Madison, Wis.

A SERIES of tests comparing the strength and ductility of new billet steel and rerolled steel reinforcing bars has been made at the Engineering Experiment Station, University of Wisconsin, and is reported in the Bulletin of the University of Wisconsin, Engineering Series 1252, Vol. IX, No. 3, just published. The tests were carried on as part of the school work by undergraduates under the direction of the writer and Prof. M. O. Withey. The material tests consisted of new billet steel of intermediate grade, rerolled steel, and new billet steel of hard grade. The tests carried out were commercial tension tests, cold bend tests, and tension tests of the bar after it had been cold bent into both U- and V-shape and then placed in a templet.

From the tests the following conclusions were drawn:

1. Deformed bars of new billet, intermediate grade steel showed satisfactory ductility. A large percentage of the bars fell below the strength requirements, especially for ultimate strength, 50 per cent of the bars falling 11.4 per cent below the ultimate strength requirement. This lack of strength seemed to be due to low carbon content.

2. Deformed bars of new billet, hard grade steel showed a small percentage which failed to meet the ductility requirements. A large percentage of the bars failed to meet the strength requirements, 65 per cent of them falling 4.2 per cent below the ultimate strength requirement. This lack of strength seemed to be due to low carbon content.

3. Deformed bars of rerolled steel all showed satisfactory strength. A large percentage of the bars, 42.5 per cent failed to meet the ductility requirements. However, the results for the bars from one company were considerably better than those from the other company.

4. Cold bending of new billet bars, both of intermediate grade and hard grade, did not decrease the tensile strength of these bars. None of these bars failed in bending to the U- or V-shape.

5. Cold bending of rerolled bars seriously decreased the tensile strength of these bars. Furthermore, 47 per cent of these bars failed in bending to the U-shape. However, the results for the bars from one company were very much better than those from the other company.

6. The standard cold bend test and also the U-bend and V-bend tests, showed that the rerolled bars were likely to be very unreliable in the matter of uniformity of material. The micrographs and the chemical analyses helped to explain this non-uniformity.

7. Projections on the rerolled bars made it more difficult for these bars to withstand cold bending, but when the bars had proper ductility the presence of projections was of little importance.

8. The poor ductility of the rerolled bars seemed to be due either to a high carbon content, or a medium carbon content in combination with a high phosphorus content.

9. For the new billet bars the results in the U-bend and the V-bend tests were practically the same. For the rerolled bars, on the other hand, the U-bend test was considerably more severe than the V-bend test.

10. In the opinion of the writer, the new billet bars, while not meeting rigidly all the ordinary requirements for such steel, yet may be considered as reasonably satisfactory. The rerolled bars, on the other hand, while of satisfactory strength, must be considered as very unreliable for work under conditions subjecting them to cold bending.

How to Improve Material—It seems appropriate to discuss some of the ways in which these bars could be improved in view of the results given in the above bulletin.

Taking up first the new billet deformed bars of intermediate grade, the principal reason why so many bars fell below the strength requirements both as to yield point and ultimate strength seemed to be the low carbon content. Of the eight bars of this grade which were subjected to chemical analysis, the one with lowest carbon had 0.17 per cent, with a yield point of 35,000 lb. per square inch and an ultimate strength of 55,000 lb. per square inch. The one with highest carbon had 0.41 per cent, with a yield point of 56,100 lb. per square inch and an ultimate strength of 96,600 lb. per square inch.

The American Society for Testing Materials specifications do not specify any limitations for any of the elements except phosphorus, which must be not over 0.04 per cent for open-hearth bars, and not over 0.10 per cent for bessemer bars. The quality of the bars is determined by strength and ductility requirements. According to the specifications, the deformed bars of intermediate grade are to have a yield point of at least 40,000 lb. per square inch and an ultimate strength of 70,000 to 85,000 lb. per square inch.

Judging by the few chemical analyses which were made on these bars, it appears that the carbon content should probably vary from 0.30 to 0.40 per cent with the preference for 0.35 per cent.

There were eight chemical analyses made of the hard grade, deformed, new billet bars. The one with lowest carbon had 0.32 per cent, with a yield point of 43,700 lb. per square inch, and an ultimate strength of 78,100 lb. per square inch. The one with the highest carbon had 0.51 per cent, with a yield point of 50,400 lb. per square inch and an ultimate strength of 86,700 lb. per square inch. The American Society for Testing Materials specifications require a minimum yield point of 50,000 lb. per square inch, and a minimum ultimate strength of 80,000 lb. per square inch.

These hard grade bars also showed a large percentage which did not satisfy the strength requirements, and this again seemed to be due largely to low carbon content. Judging by the chemical analyses which were made, the carbon content for these bars should probably vary from 0.40 to 0.50 per cent, with the preference for 0.45 per cent. It is not desirable to have the carbon higher than is necessary to produce the proper strength, because of the fact that the ductility may be affected adversely.

The results of the tests on the new billet deformed cars, both of intermediate grade and hard grade, indicate that it would be desirable for the manufacturers of new billet bars to do some research work to determine what the limits of the chemical ingredients should be so that a larger percentage would be able to pass the specifications. The tests indicate that it should be fairly easy to accomplish the purposes desired.

In connection with the tests of the rerolled bars, attention should be called to the investigation made by Prof. W. K. Hatt and reported in the *Proceedings* of the American Society for Testing Materials in 1913. From the information given in this report, it is not possible to determine the weight of rail from which the different bars were rolled. This is unfortunate because the Wisconsin tests show that it is probably the higher carbon in the heavier rails which causes lack of ductility in many of the bars. The only bars mentioned in

Professor Hatt's report which came from definite weights of rails are some from 80-lb., 75-lb., 60-lb., and 55-lb. rails. Since rails are now rolled up to 120 lb with carbon up to 0.75 per cent, it is seen that many failures may come from the use of the heavier rails.

Fig. 16 of Professor Hatt's report shows that only 2 per cent out of 303 deformed bars failed to meet the ductility requirement as represented by percentage of elongation. His Table V indicates that only 11 per cent of 301 deformed bars failed to meet the ductility requirement as represented by the cold bend test. The Wisconsin tests, on the other hand, showed 42.5 per cent of the deformed bars deficient in ductility.

The percentage of carbon and phosphorus was determined for 28 rerolled bars. The bar with the lowest carbon had 0.24 per cent, and that with the highest carbon had 0.72 per cent. According to the American Society for Testing Materials specifications, bessemer steel rails up to a weight of 84 lb. may have carbon up to 0.50 per cent and phosphorus up to 0.10 per cent. Open-hearth steel rails of the same weight may have carbon up to 0.66 per cent and phosphorus up to 0.04 per cent. Of the bars in the Wisconsin tests which failed because of lack of ductility and for which the chemical analyses were available, 6 had more than 0.10 per cent phosphorus combined with carbon from 0.42 per cent up, 2 had 0.44 per cent and 0.48 per cent carbon, with phosphorus 0.099 per cent and 0.099 per cent, 1 had 0.48 per cent carbon and 0.072 per cent phosphorus, and 5 had carbon from 0.59 per cent up to 0.83 per cent with phosphorus not over 0.047 per cent.

These results seem to indicate that bars rolled from bessemer rails may be too brittle with carbon as low as 0.42 per cent, and bars rolled from open-hearth rails may be too brittle with carbon as low as 0.59 per cent. It is understood, of course, that the manganese and silicon contents undoubtedly had some influence on the results. The silicon is limited by the specifications to 0.20 per cent for both bessemer and open-hearth rails, while the manganese called for it 0.80 to 1.10 per cent for bessemer and 0.60 to 0.90 per cent for open-hearth rails.

If carbon as low as 0.42 per cent for bessemer rails and as low as 0.59 per cent for open-hearth rails may produce reinforcing bars which are too brittle, then this leads to the conclusion that all rails above 85 lb. in weight should not be used to make reinforcing bars.

Whether this conclusion is correct or not, could easily be established by research work on the part of the manufacturers of rerolled reinforcing bars. In the interests of safe construction such work should be carried out, and if the results are as indicated then the heavier rails should not be rerolled into reinforcing bars.

Weathering Tests of Building Stone

Investigation at the Bureau of Standards of the Weathering properties of building stone, consisting of actual freezing and salt crystallization tests, is beginning to give some information on weathering qualities. In particular, the exposure tests to determine the disintegrating effects of efflorescence have shown that excessive amounts of rainwater leaching through limestone masonry can produce disintegration in as short a time as one year. Surface treatment with certain colorless waterproofing materials is of benefit in preventing efflorescence under severe conditions of leaching.

Floors for Railway Buildings

GENERAL practice in floor construction for railway buildings of different classes is indicated by returns from thirty-seven leading railways in a report presented by the Committee on Buildings of the American Railway Engineering Association. The committee's conclusions are as follows:

Freight Houses — A plank floor laid on wood joists is satisfactory and economical, except in important locations, and is suitable for all frame buildings. Where considerable trucking is done, a maple wearing surface is recommended. In larger and more important freight houses, a floor of greater first cost is justified and is usually concrete. Concrete is fairly permanent, sanitary and easy to keep clean. The disadvantages are failure of the wearing surface, especially at expansion joints, and an unyielding surface, which occasionally produces complaints from truckers. Expansion joints should be as few as possible and located outside of the heavily used surface where practical. If a concrete surface is not considered suitable, a wearing surface of square-edge maple, wood or asphalt blocks or asphalt mastic may be laid over the concrete floor.

Freight Storage Houses — For these houses, which are usually of fireproof construction, concrete floors are generally approved.

Freight Piers—Floors must largely conform to the style of construction of the pier. They should be fire-resisting and in many cases must have flexibility enough to take up the vibration caused by the movement of boats along the pier.

Engine Houses—For minor houses, where not many running repairs are made, a floor of clean engine ashes, well compacted, is sufficient. For houses of more importance, concrete or brick is necessary. For houses of still higher grade, a floor of brick or creosoted wood blocks on a concrete base is suitable if the greater initial cost is justified. Asphalt floors, either mastic or block, if used for engine houses, should be of such composition as to resist the action of steam and oil.

Machine Shops—In small buildings a wood plank floor, of thickness suited to the service, is common practice. For buildings of a higher grade, wood blocks (preferably treated), asphalt blocks or mastic give excellent results. Concrete floors may be used where local conditions justify this construction as economical, although their lack of resiliency may result in discomfort to employees and the hard surface may damage tools dropped upon it.

Freight Car Repair Shops—Wood floors can be used if something better than cinders is desired and if provision has to be made for trucking material between tracks. Concrete is satisfactory for a floor of higher grade.

Blacksmith Shops — Cinders, earth or clay are to be preferred.

Carpenter Shops — Where considerable bench work is done, wood plank floors are desirable because of the comfort to workmen. Concrete floors are more easily kept clean and are sometimes used.

Store Houses—Concrete floors are satisfactory and are in common use, but where very heavy material is handled, wood blocks, asphalt block or mastic are to be preferred. In small store houses the ordinary wood plank floor is commonly used.

Paint Shops — In passenger car paint shops a concrete floor meets all requirements and it is doubtful if a more expensive type of floor is justified. In freight car shops, where paint is sprayed on, a floor of cinders is suitable.

Oil Houses—Because of the necessity for firepoof construction, concrete is recommended.

Transfer Platform — Wood planks should preferably be laid parallel to the line of trucking traffic. Metal plates may be used for a runway to facilitate trucking and to reduce wear on the plank. Concrete is used in some cases, and for extremely heavy traffic a concrete base with creosoted wood or asphalt block or asphalt mastic wearing surface.

From Job and Office

Hints That Cut Cost and Time For the Contractor and the Engineer

Brazing Cracks in 30-In. Cast-Iron Water Pipe

CRACKS IN a 30-in. water main, Rhode Island Avenue, Washington, D. C., extending from a point near the end of a 12-ft. section around the pipe to a point near the other end, were repaired recently by the use of an oxyacetylene torch and tobin bronze welding rod. The shell of the pipe was about 1 in. thick.

The first step in the operation was to melt out the lead joints by the oxyacetylene flame, so the pipe could be turned and all the brazing work done along its top. Owing to the confined space, no attempt to preheat the pipe was made. Consequently, two short new cracks at

CAST-IRON MAIN AFTER REPAIR BY OXYACETYLENE

right angles to the main crack were formed. These were also closed by brazing.

The tobin bronze rod used on the work was bridged over the top of the crack instead of being worked into it. The total width of braze was from 2½ to 3 in. and the thickness of bronze applied was about ½ in. The total length of braze was 15 ft. Altogether 43 lb. of tobin bronze and 2 lb. of flux were used, together with 350 cu.ft. of oxygen and an equal amount of acetylene. Eight man-hours were required for the job. The cost of the work was about $60 against an estimated cost of $200 for material and labor required to have inserted a new 12-ft. section of pipe.

The only thing done to the pipe before starting the brazing operation was to burn off the coating and then clean the surface with a wire brush. The pipe had been but recently installed and was not corroded.

J. S. Garland is superintendent of the Water Department of the District of Columbia. The foregoing information was supplied by R. B. Swope, manager of the Southern Oxygen Co., South Washington, Va., which supplied the equipment and material used for the repair work.

Chlorine Control at Wilmington Filter Plant

By W. Compton Wills
Assistant Engineer Water Distribution, Wilmington, Del.

TO CONTROL the rate of chlorination at the water filtration plant at Wilmington, Del., hourly orthotolodin determinations of residual chlorine are telephoned to the operator in charge of regulating the dosage. He makes use of a table which shows the number of pounds of chlorine to be added to or deducted from the dosage used during the previous hour.

The mechanical filter plant at Wilmington, with a capacity of 14 m.g.d., is supplied with raw water by gravity from an open raceway heading in Brandywine creek, about one-half mile above the filter plant. After sedimentation and filtration the water flows into a 0.5 m.g. clear-water reservoir. This reservoir is connected by 500 ft. of 36-in. diameter pipe to a suction pit under a steam turbine room. The floor elevations of the clear-water reservoir and the turbine suction pit are practically the same.

Chlorine solution is applied through a connection in the 36-in. pipe just as the water leaves the clear-water reservoir. The tests for residual chlorine and for bacteria are made on samples of water drawn from the turbine suction pit, about 500 ft. from the point of application.

For some time past it has been the practice to control the chlorine dosage by interpreting the results of orthotolodin tests made each day at 8 a.m., 12 noon, and 5 p.m. The results of these tests proved to be very irregular as shown by the following records (p.p.m.) of three representative days:

	8.00 a.m.	12.00 noon	5.00 p.m.
Feb. 19	.10	.10	.04
Feb. 20	.06	.08	.13
Feb. 21	.01	.01	.01

At times the residual chlorine would disappear entirely after a morning, noon, or evening reading. The irregularity may have been caused by wastes from manufacturing plants located on the watershed, variation in coagulation and sedimentation at the filter plant, or perhaps decayed vegetable matter accumulating on the watershed and carried down at intervals by the storms, or laxity on the part of the filter operators in turning on a duplicate chlorinator as the other chlorinator exhausted.

For periods extending over two or three days the excess free chlorine reading would be held within the required range by the addition of chlorine at the rate of from 0.25 to 0.33 p.p.m. Then for a short period it would be necessary to add chlorine at the rate of from 0.5 to 1 p.p.m. to secure the same residual chlorine. At the same time the bacterial results showed the same irregularities.

As a first step to control efforts the watershed inspection was extended. While many possible chances for pollution affecting chlorine dosage were found, it was obvious that time was necessary to prove by laboratory

experiments that the fault lay in any certain place. However, the various manufacturing plants were warned and the tests started.

But as an immediate relief to overcome the variation in the residual chlorine and in turn the variation in bacterial results, a plan was devised whereby hourly tests for residual chlorine extending through the whole 24 hours of each day were to be made. Such hourly tests would show the records of periods of variation and could be used in connection with the watershed inspection for pollution, and would further serve to reduce to one-hour periods any chance of insufficiently chlorinated water passing into use.

The hourly tests are made by the oilers in the turbine room. Standards were selected representing values of 0.02, 0.04, 0.06, 0.08, 0.1, 0.15, 0.2, 0.3, and 0.4 p.p.m. The allowable range of excess free chlorine was taken as 0.06 to 0.1 p.p.m. When the oiler finds 0.06 to 0.1 p.p.m. inclusive, no report is made and the water is assumed to be safe as to quantity of chlorine. But when less than 0.06 p.p.m. and more than 0.1 p.p.m. is found this oiler telephones the filter plant operator the amount found. The filter plant operator accepts the amount and refers to the following chart at the filter:

RESIDUAL CHLORINE: LIMITS 0.06 TO 0.11 P.P.M.

IF	Add to Present Rate	Deduct From Present Rate
0 p.p.m.	5 lb.	....
.02 p.p.m.	4 lb.	....
.04 p.p.m.	2 lb.	....
.12 p.p.m.	....	2 lb.
.14 p.p.m.	....	3 lb.
.16 p.p.m.	....	3 lb.
.18 p.p.m.	....	4 lb.
.20 p.p.m.	....	4 lb.
.30 p.p.m.	....	5 lb.

On receiving the oiler's report of the parts per million the filter operator finds from the above table how many pounds of chlorine to add or deduct from amount being applied. The oiler uses this blank:

Residual Chlorine

Date ..... May 3, 1924 .....

A. M.	P.P.M.	P. M.	P.P.M.	Taken by	Bact. Sample
1.00	.04	.....	...	A. M.	.....
2.00	.06	.....	...	A. M.	.....
3.00	.04	.....	...	A. M.	.....
4.00	.06	.....	...	A. M.	.....
5.00	.06	.....	...	A. M.	.....
6.00	.04	.....	...	A. M.	.....
7.00	.10	.....	...	A. M.	.....
8.00	.15	.....	...	W. H.	.....
9.00	.15	.....	...	W. H.	.....
10.00	.17	.....	...	W. H.	M. A.
11.00	.15	.....	...	W. H.	.....
Noon	.13	.....	...	W. H.	.....
.....	...	1.00	.13	W. H.	.....
.....	...	2.00	.12	W. H.	.....
.....	...	3.00	.10	W. H.	.....
.....	...	4.00	.15	J. D.	.....
.....	...	5.00	.06	J. D.	.....
.....	...	6.00	.09	J. D.	.....
.....	...	7.00	.09	J. D.	.....
.....	...	8.00	.09	J. D.	.....
.....	...	9.00	.09	J. D.	.....
.....	...	10.00	.08	J. D.	.....
.....	...	11.00	.08	J. D.	.....
.....	...	Midnight	.06	A. M.	.....

On this blank the excess chlorine readings are recorded, the oiler's initials, time of testing; also the time of taking bacterial samples and initials of the bacteriologist, which should prove favorable or unfavorable according to the residual chlorine record.

Night reading is aided by a black testing table with a white slab, and a desk lamp with a shade, the light striking the side of the tubes.

Since starting these frequent tests the bacterial results have been more consistent and records are being obtained which, when used in conjunction with findings on the watershed, should prove of value in eliminating the cause of the variation in chlorine control.

Simple and Efficient Grouting Outfit

By R. W. Cropper
R. W. Cropper Engineering Co., Kansas City, Mo.

During the construction of the South Dakota highway bridge over the Missouri River, near Geddes, S. D., it was found that the surface of the substratum of rock underlying the river at the bridge site was covered with a layer of coarse sand and gravel of such a porous nature that it effectively stopped the work of sinking the 12-ft. diameter steel cylinders which were to form the foundations for the bridge piers. Grouting of this material was resorted to in order to complete the piers.

The specifications required that the cylinders be sunk to 5 ft. below the surface of the rock. When the first one reached the rock surface it was found that on account of the dip of the surface one edge of the cyinder rested on the rock, while the other was so

GROUTING ARRANGEMENT FOR BRIDGE PIER WORK
A: Grout mixing box—B: Group discharge box—C: Duplex steam pump—D: Jet pipe—E: Hose connection.

far above the surface that water coming in through the sand and gravel prevented any work in the bottom of the cylinder without resorting to pneumatic methods. To avoid this, it was decided to grout the sand and gravel surrounding the lower part of the steel cylinders. The apparatus used for this work is shown in the accompanying cut. It consisted of the two boxes *A* and *B*, each with a capacity of 124 gal., a duplex steam pump *C*, a hose connection *E*, and the 1¼-in. jet pipe *D*. The grout was mixed in the proportions of 124 gal. of water to 10 bags of cement. This gave a grout with a consistency of oil paint. No sand was used in the mixture.

The cycle of operation consisted in filling box *A* with the required amount of grout and box *B* with water. The pump was then started, using water from box *B* for the jetting. It required half the capacity of box *B* to sink the jet pipe to the proper elevation. The remainder of the water in box *B* was then pumped down through the jet pipe with the idea of opening up passages from the end of the pipe through the sand and gravel before the grout started to flow. Before box *B* was completely emptied the grout in box *A* was discharged into *B* without stopping the pump, so that there was a continuous flow from the bottom of the jet into the surrounding sand and gravel. Previous

to starting the grouting operation around each cylinder, the cylinder was allowed to fill with water so that there would be little or no movement of the water in the sand and gravel at the lower end. When all the batch of grout had been pumped down the jet pipe, the pipe was raised 10 or 15 ft. and more water pumped down to it to clear out the system. A complete cycle required from 15 to 30 min., depending on the amount of time required for jetting down the pipe. About eight separate jetting operations were performed around each cylinder and the time occupied was usually about three hours.

The grout was allowed to set for three days before unwatering the cylinder. At the end of this time it was found that one 3-in. pump operating to about 25 per cent of its capacity could keep the cylinder unwatered, but in order to insure good concrete in the bottom of the cylinders each one was allowed to refill with water after the excavation had been carried to the required depth below the rock surface. Then concrete for the 5-ft. seal at the bottom was placed with a tremie.

Examination of the material excavated around the lower end of the cylinders after the grouting showed that in most cases the grout had mixed with the sand and gravel, making an excellent concrete. In a few places, however, it had collected in pockets instead of mixing with the surrounding material. Apparently these pockets were the cause of the incomplete sealing of the cylinders.

The apparatus was developed by John P. Coughlan, construction superintendent for the Kansas City Bridge Co. J. E. Kirkham is bridge engineer for the state of South Dakota, in charge of the work.

Yardage Tables for Highway Work

By H. A. Sitterley
Winston-Salem, North Carolina

When computing yardage in highway construction some convenience may be found in the use of the tables herewith reproduced. To use the tables proceed thus:

Follow down the columns on the left of the heavy black line until the whole number representing the average end area is found; note the number above the column (100, 200, etc.) and then look under the tenths column at the right of the heavy line for the balance of the yardage. Thus, if the average end area is 432.2, find 432 in the 1,600 column, and under 0.2 and opposite 432 find 0.74, which, added to 1,600, makes 1,600.74, number of cubic yards for a 100-ft. station. For shorter stations multiply this result by the length of station used as a decimal part of 100.

CUBIC YARDS OF MATERIAL PER 100-FT. STATION FOR AVERAGE END AREAS

1,600	1,500	1,400	1,300	1,200	1,100	1,000	900	800	700	600	500	400	300	200	100	0	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
432	405	378	351	324	297	270	243	216	189	162	135	108	81	54	27	0	0.00	0.37	0.74	1.11	1.48	1.85	2.22	2.59	2.96	3.33
433	406	379	352	325	298	271	244	217	190	163	136	109	82	55	28	1	3.70	4.07	4.44	4.81	5.18	5.55	5.93	6.30	6.67	7.04
434	407	380	353	326	299	272	245	218	191	164	137	110	83	56	29	2	7.41	7.78	8.15	8.52	8.89	9.26	9.63	10.00	10.37	10.74
435	408	381	354	327	300	273	246	219	192	165	138	111	84	57	30	3	11.11	11.48	11.85	12.22	12.59	12.96	13.33	13.70	14.07	14.44
436	409	382	355	328	301	274	247	220	193	166	139	112	85	58	31	4	14.81	15.18	15.55	15.93	16.30	16.67	17.04	17.41	17.78	18.15
437	410	383	356	329	302	275	248	221	194	167	140	113	86	59	32	5	18.52	18.89	19.26	19.63	20.00	20.37	20.74	21.11	21.48	21.85
438	411	384	357	330	303	276	249	222	195	168	141	114	87	60	33	6	22.22	22.59	22.96	23.33	23.70	24.07	24.44	24.81	25.18	25.55
439	412	385	358	331	304	277	250	223	196	169	142	115	88	61	34	7	25.93	26.30	26.67	27.04	27.41	27.78	28.15	28.52	28.89	29.26
440	413	386	359	332	305	278	251	224	197	170	143	116	89	62	35	8	29.63	30.00	30.37	30.74	31.11	31.48	31.85	32.22	32.59	32.96
441	414	387	360	333	306	279	252	225	198	171	144	117	90	63	36	9	33.33	33.70	34.07	34.44	34.81	35.18	35.55	35.93	36.30	36.67
442	415	388	361	334	307	280	253	226	199	172	145	118	91	64	37	10	37.04	37.41	37.78	38.15	38.52	38.89	39.26	39.63	40.00	40.37
443	416	389	362	335	308	281	254	227	200	173	146	119	92	65	38	11	40.74	41.11	41.48	41.85	42.22	42.59	42.96	43.33	43.70	44.07
444	417	390	363	336	309	282	255	228	201	174	147	120	93	66	39	12	44.44	44.81	45.18	45.55	45.93	46.30	46.67	47.04	47.41	47.78
445	418	391	364	337	310	283	256	229	202	175	148	121	94	67	40	13	48.15	48.52	48.89	49.26	49.63	50.00	50.37	50.74	51.11	51.48
446	419	392	365	338	311	284	257	230	203	176	149	122	95	68	41	14	51.85	52.22	52.59	52.96	53.33	53.70	54.07	54.44	54.81	55.18
447	420	393	366	339	312	285	258	231	204	177	150	123	96	69	42	15	55.55	55.93	56.30	56.67	57.04	57.41	57.78	58.15	58.52	58.89
448	421	394	367	340	313	286	259	232	205	178	151	124	97	70	43	16	59.26	59.63	60.00	60.37	60.74	61.11	61.48	61.85	62.22	62.59
449	422	395	368	341	314	287	260	233	206	179	152	125	98	71	44	17	62.96	63.33	63.70	64.07	64.44	64.81	65.18	65.53	65.93	66.30
450	423	396	369	342	315	288	261	234	207	180	153	126	99	72	45	18	66.67	67.04	67.41	67.78	68.15	68.52	68.89	69.26	69.63	70.00
451	424	397	370	343	316	289	262	235	208	181	154	127	100	73	46	19	70.37	70.74	71.11	71.49	71.85	72.22	72.59	72.96	73.33	73.70
452	425	398	371	344	317	290	263	236	209	182	155	128	101	74	47	20	74.07	74.44	74.81	75.18	75.55	75.93	76.30	76.67	77.04	77.41
453	426	399	372	345	318	291	264	237	210	183	156	129	102	75	48	21	77.78	78.15	78.52	78.89	79.26	79.63	80.00	80.37	80.74	81.11
454	427	400	373	346	319	292	265	238	211	184	157	130	103	76	49	22	81.48	81.85	82.22	82.59	82.96	83.33	83.70	84.07	84.44	84.81
455	428	401	374	347	320	293	266	239	212	185	158	131	104	77	50	23	85.15	85.55	85.93	86.30	86.67	87.04	87.41	87.78	88.15	88.52
456	429	402	375	348	321	294	267	240	213	186	159	132	105	78	51	24	88.89	89.26	89.63	90.00	90.37	90.74	91.11	91.48	91.85	92.22
457	430	403	376	349	322	295	268	241	214	187	160	133	106	79	52	25	92.59	92.96	93.33	93.70	94.07	94.44	94.81	95.18	95.55	95.93
458	431	404	377	350	323	296	269	242	215	188	161	134	107	80	53	26	96.30	96.67	97.04	97.41	97.78	98.15	98.52	98.89	99.26	99.63
1,600	1,500	1,400	1,300	1,200	1,100	1,000	900	800	700	600	500	400	300	200	100	0	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9

From Job and Office

Hints that Cut Cost and Time

A Method of Designing Partially Fixed Arch Bridges

By Arthur G. Hayden
Senior Designing Engineer, Bronx River Parkway Commission, Bronxville, N. Y.

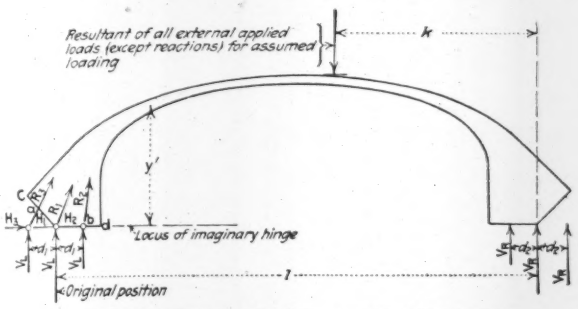
Mention has been made in a previous article in *Engineering News-Record* (Jan. 11, 1923, p. 73) of the design of reinforced-concrete beam bridges faced with stone arch rings to resemble true arched bridges. These designs were adopted for several Bronx River Parkway bridges for the sake of economy because, in a fixed arch, abutments and foundations capable of maintaining fixity at the ends of the arch ring proper under all conditions of loading and temperature may cost as much as or more than the arch itself and result in a comparatively costly structure. Two small bridges have been recently built on the Parkway having small abutments not heavy enough to maintain fixity at the ends of the arch, the stresses in the arch being calculated for partial fixity. The method seems to be entirely sound and it is believed that it will be applicable to bridges of much greater span and result in structures more economical than the stone-faced beam-type used on the Parkway.

Refer to the diagram, which represents an arch with light abutments. It is obvious that the resultant reactions cannot fall at or beyond the edges *c* or *d* of the abutments since that would produce impossible conditions of earth pressure at these points. There are points *a* and *b*, dependent upon the elasticity of the soil, between which the resultant reaction must lie and within which it may move due to changing conditions of

From Job and Office

For Contractor and Engineer

loading and temperature. The problem of analysis resolves itself into selecting an abutment of proper size to give a reasonable soil pressure, though not necessarily of sufficient magnitude to produce fixity in the arch ring, and analyzing the ring for such positions of the reactions, within a reasonable range, that will give the maximum conditions of stress. The application of this method was facilitated by formulas of correction



SHIFTING REACTIONS IN ARCH ANALYSIS

derived by Dudley P. Babcock of the Bronx Parkway Commission's designing force.

The procedure is as follows: Points of reactions are tentatively assumed and the direction and magnitudes of the reactions determined as for an arch hinged at these points. If the stresses at any particular point are increased by moving one imaginary hinge outward or inward a distance d_1 from the center, it may be shown that the stresses will be still further increased by moving the other imaginary hinge also outward or inward a certain distance d_2 and that no appreciable error will be involved by assuming that these distances are such that V_L and V_R remain unchanged in amount.

Let s = length of a division of the arch ring measured along the arch axis. If s is made constant the quantity will disappear from the formulas.

I = moments of inertia of the arch divisions.

y = the ordinates (used in summation) of the center points of the arch divisions.

y' = the ordinate of the point at which the moments are desired. Then it may be shown that the increment in total moment at any point (ΔM) is equal to

$$V_L d_1 \left(1 - y' \frac{\sum \frac{ys}{I}}{\sum \frac{y^2 s}{I}}\right) \quad \text{or} \quad V_R d_2 \left(1 - y' \frac{\sum \frac{ys}{I}}{\sum \frac{y^2 s}{I}}\right)$$

and that the increment in horizontal thrust (ΔH) is equal to

$$V_L d_1 \frac{\sum \frac{ys}{I}}{\sum \frac{y^2 s}{I}} \quad \text{or} \quad V_R d_2 \frac{\sum \frac{ys}{I}}{\sum \frac{y^2 s}{I}}$$

The signs of d_1 and d_2 are positive when the new imaginary hinge points are moved farther apart and negative when they are moved closer together. The relation between d_1 and d_2 is such that $d_1 = \frac{d_2(l-k)}{k}$, l being the span length originally assumed center to center of imaginary hinges and k being the distance of the resultant of all external applied loads from the right imaginary hinge.

In order to avoid a new set of calculations involving new values of y, the locus of the imaginary hinges is kept horizontal. Stresses in the arch ring due to yielding of the foundations may be calculated.

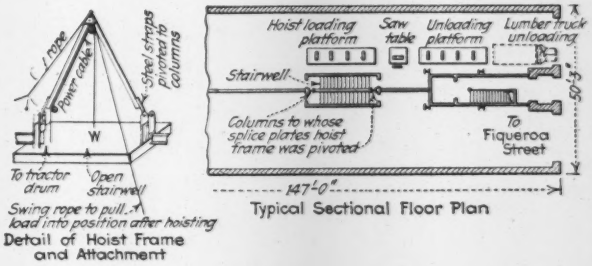
The commission hopes to test one or both of these bridges by moving some of the commission's heavy construction machinery over the structures.

Efficient Lumber Handling on Los Angeles Building Construction

By Zara Witkin
Construction Manager, H. M. Baruch, Constructors, Los Angeles, California

IN THE construction of the A. C. Martin Building in Los Angeles, the contractors used means of handling lumber well adapted to the particular design of the building. The building, approximately 50 x 150 ft., is a six-story store and loft structure, with exterior bearing walls of brick and interior loads carried on steel columns. The floors are of wood joist construction. It is in the placing of these joists and minor elements of the timber framing that the special arrangement of equipment worked so successfully.

Located on the center line of the building, approximately 50 ft. back from the property line is the main stairwell, which is double and has an area of approxi-



FLOOR PLAN OF BUILDING AND DETAILS OF LUMBER-HANDLING APPARATUS

mately 21x10 ft. At each end of this stairwell on the center line, are H-columns running up the full height of the building. As the structure progressed, this well was left completely open and an A-frame without the cross-member was built with heavy straps on the supporting ends, the straps being bored through for ⅞-in. bolts which were threaded through the rivet holes on the connections of the columns. The top of this A-frame carried a pulley, over which ¾-in. cable passed. Another pulley, at one support point of the A-frame, passed the cable down again. At right angles to the plane of the frame a guy rope held it in whatever position the placement rope on the other side pulled it.

On the ground floor a load of heavy framing lumber would be delivered by truck, backing up against a platform carrying rollers. The lumber would then be rolled directly over the saw table, and from the saw table to another rolling platform immediately adjacent from which it arrived directly below the large stairwell, where it was rigged in loads with the cable, hoisted to position by a drum on the front end of a

Fordson tractor; and when arriving at the floor that was being framed swung to position by a single man.

No more direct routing of the lumber could be devised under the conditions; and the whole operation was performed with the practical minimum of labor. The lumber was delivered load by load as required, and no storage space on the job was required. When a floor was framed, the only thing necessary to set the system in operation on the next floor was to disconnect the two pivot bolts, and after the next story of column steel was placed again to fasten these bolts through the strap bottoms of the A-frame in the column connections.

This building will be completed by about the middle of August of this year, having been started early in April, construction proceeding under a bonus and penalty clause, and a strict time schedule for all operations. The architect is A. C. Martin, and the contractors H. M. Baruch, Los Angeles.

Sheds Store Aggregate for Road Patches

USE OF the cut-back patch has been developed extensively in Ohio in maintaining Ohio highways, both asphalt and tar being used. A great source of trouble has been found in the moisture content of the aggregate. In addressing the recent Purdue University road school H. S. Perry, assistant chief engineer of maintenance, asserted that he had frequently observed the curing mix covered with tarpaulin and untreated aggregate left unprotected. This condition led him to advise the construction of mixing sheds primarily designed for guaranteeing a dry aggregate. They also provide quarters in which to carry on the work in inclement weather and to house some equipment.

The drawing herewith (Type C) illustrates one type of cold patch shed. The photograph herewith repro-

From Job and Office

Hints that Cut Cost and Time

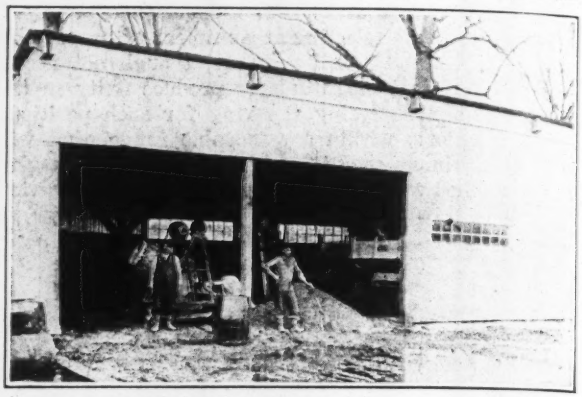


FIG. 2—SHED WITH EQUIPMENT STORAGE PROVIDED

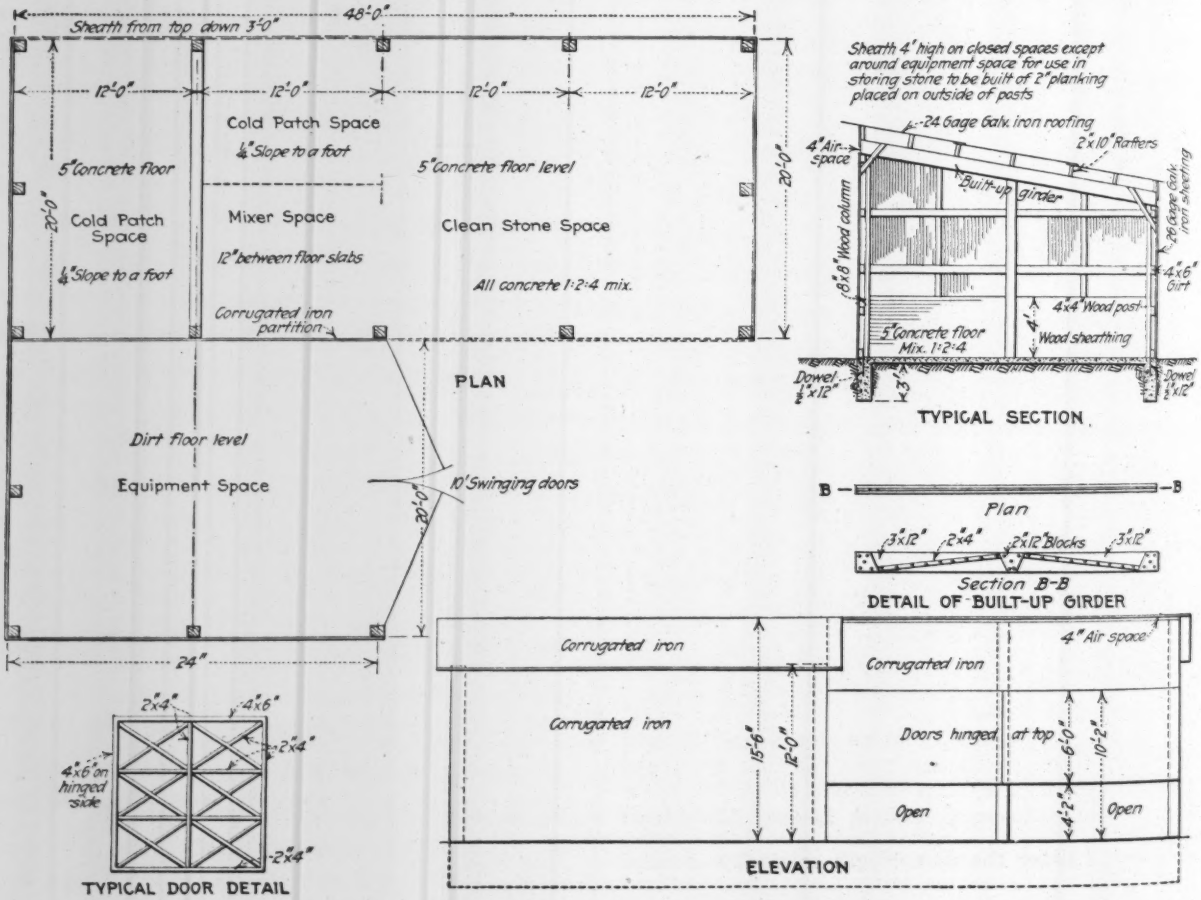


FIG. 1—DETAILS OF TYPE B COLD PATCH SHED

From Job and Office

For Contractor and Engineer

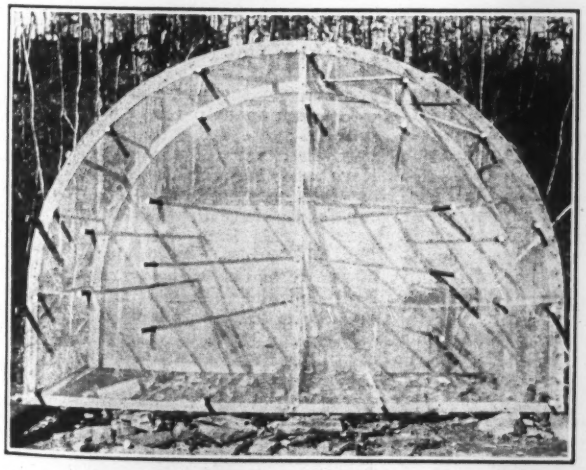
duced (Type B) illustrates a shed built approximately according to the design shown in the sketch except for the fact that the equipment space is included in the photograph. This space is used by trucks during the winter for storage purposes and during the working season as a storage space for dry stone. It has a capacity of 60 tons. The mixer is of standard construction for cold patch purposes. A concrete floor and approaches are yet to be provided. Approximately 50 of these two types with minor variations have been erected in various locations over the state and it is proposed to erect a great many more of them. The cost of the Type C shed complete is approximately $1,300, and that of Type B about $1,100.

Tunnel Heading Model Shows Standard Round of Holes

WHEN members of the American Society of Civil Engineers recently attended the convention in Atlanta, Ga., one of the projects visited was the Terrora project of the Georgia Railway & Power Co., Tallulah Falls. Part of the work inspected was a power tunnel. In explanation of the method in which holes were drilled in the heading of the tunnel, the model herewith pictured was devised by J. E. O'Rourke, resident superintendent of the Terrora project.

The tunnel bore is 15 ft. high by 13 ft. wide. The spring line is 8½ ft. above floor grade and the radius of the arch is 6½ ft. The heading is carried the full width of the tunnel and 9½ ft. in height; and vertical columns with arms are used, as this type of mounting permits more accurate placement of drill holes.

The heading face is always carried 40 to 50 ft. in advance of the bench face. Two 6½-ft. heading rounds and one 13-ft. round are broken every 24 hours. The bench is broken with six horizontal holes—two splitters and four lifters. Delay action exploders and 40 and 60 per cent gelatin dynamite have been used successfully in the blasting operations. All connections are made in multiple.



MODEL OF POWER TUNNEL HEADING

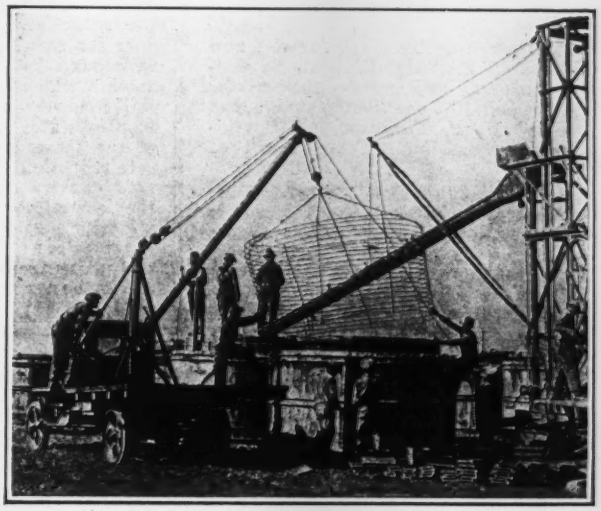
A description of the holes in the heading round and placement of delay action exploders is as follows:

6 cut holes	No delay exploders	1 center breaking down hole	3rd delay exploders
4 cut relievers	1st delay exploders		
4 rib holes and 2 breaking-down holes	2nd delay exploders	5 arch holes	4th delay exploders
		2 center lifters	5th delay exploders
		2 corner lifters	6th delay exploders

Reference to the photograph will explain this placement of exploders.

Truck with Crane Facilitates Handling Forms for Large Sewer Pipe

A SMALL motor-driven winch and derrick mounted on a truck was found an effective means of saving time and labor in handling steel forms used by the



HANDLING FORM SECTIONS IN THE CASTING YARD

Western Concrete Pipe Co. in casting pipe for the new sewer outfall at Los Angeles, Calif. The forms are moved about the casting yard and swung into position on an iron base with the aid of a truck equipped as shown in the accompanying picture. The winch is connected to the truck motor by means of a clutch and is operated by the truck driver.

This pipe is lined with clay tile which are shown in the picture on the inner forms against which they are held in place by wires while the concrete is setting.

Track Economies on the Lehigh Valley R. R.

Economies of treated ties and heavy rails are noted in the 1923 annual report of the Lehigh Valley R.R. More than 66 per cent of this road is now equipped with creosoted ties, of which 317,519 were placed last year. This preservative treatment materially reduces expenditures for maintenance-of-way, and the number of ties used annually in renewals is now considerably less than half the number used before this practice was adopted. The 136-lb. rail was laid on more than 98 miles of track last year and now extends over 55 per cent of the main line. This weight of rail has been used since 1916 with the result that the average annual tonnage of new rails laid has been considerably less than the average for twelve years prior to 1916.

News of the Week

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

News Brevities

Fees Collected by the State automobile department that go to the highway commission for road work in Indiana after the expenses of the automobile department are paid amount to $4,813,400 for the first six months of the present year.

In Appointing Trustees for the new Springfield Sanitary District, to provide sewerage and sewage disposal for Springfield, Ill., the county judge has included H. F. Ferguson, chief engineer of the Illinois State Board of Health.

Development of the Exchequer Dam site by the Merced Irrigation District is expected in the near future. The Federal Power Commission has issued a license for the construction of this project and the irrigation district plans to begin construction as soon as the bonds are sold.

Plans for Storage Reservoirs on the Ste. Anne de la Perade River, the Riviere du Loup and the Riviere du Nord, are under consideration by the Quebec Running Streams Commission. The damming of the St. Anne River will cost $500,000, of the Riviere du Loup $300,000 and the Riviere du Nord $300,000. These reservoirs will supply water to increase the low winter flow of these streams.

Turning One Day's Pay Back to the railroad each month is the novel plan adopted by all officers of the Canadian National Rys. above the rank of chief clerk, in order to help keep down the operating expenses of the railroad during the part of the year when business is slack. Many employees in the company's shops have agreed to work three weeks out of each month during the same period, in order to prevent a reduction of the staff, which would throw a number of their fellow-employees out of work.

A Fight to Prevent the Southern Pacific from acquiring control of the El Paso & Southwestern Ry. has been started by the city of El Paso, Texas. Opposition to the merger is based on the belief that the elimination of passenger and freight rate competition by the consolidation, will work a serious injury upon El Paso as a distribution and jobbing center, and virtually reduce the city to a one railroad town. Details of the arrangement between the two railroad companies have been completed: it now requires only the approval of the Interstate Commerce Commission to make it effective. The consolidation of the El Paso & Southwestern with the Southern Pacific is in line with the Interstate Commerce Commission's plan for railroad consolidation.

I. C. C. Denies Rate Reduction Plea of Midwest

By a majority of only one vote the Interstate Commerce Commission has denied the reduction in rates on grain and hay sought by ten states in Mississippi and Missouri valley region. In its decision the commission states that the reduction desired would reduce the earnings of the western railroads by $17,500,000, an amount which their present financial condition does not warrant. It also states that the condition of the farmers is improving. A rate reduction on the grain products concerned was granted by the commission in 1922. The minority opinion states that grain prices have reached a new and permanent lower level which should be recognized by the railroads.

Pittsburgh Base System of Fixing Steel Price Ordered Abandoned

In a mandate handed down July 22 the Federal Trade Commission has ordered the U. S. Steel Corporation to discontinue its practice of predicating the price of steel upon the Pittsburgh base. The effect of such a method of fixing the price of steel can most readily be seen by the fact that Duluth consumers, for example, have had to pay the Pittsburgh base price plus the imaginary freight rate from Pittsburgh to Duluth, though the steel itself was manufactured in the latter city.

The Commission initiated its investigation of the Steel Corporation's price-fixing system at the instigation principally of the Western Association of Rolled Steel Consumers, and as an outgrowth of the complaint of more than 2,700 fabricators of steel in the Chicago, Duluth and Birmingham districts, by the legislatures of three states and by numerous business and commercial organizations throughout the country. The formal complaint was issued April 30, 1921.

The Commission held that the Pittsburgh base plus system is an unfair method of competition, that it is a violation of the Federal Trade Commission Act, and a means of price discrimination in violation of the Clayton Act. The Commission also gave as its opinion that the Pittsburgh base plus system lessens competition, retards business in all steel centers except Pittsburgh, and add greatly to the cost of steel production. The Commission estimates farmers of 11 western states have an extra steel bill of $30,000,000 yearly to pay because of the base plus plan.

Drought in California Is Worst on Record

Half of Runoff of Previous Driest Year Recorded—Situation Grows Worse Daily

Heretofore the driest year since the power companies of California have been keeping records was 1919. During this year the flow has been only one-fourth to one-half the 1919 runoff in most of the important streams of the state. As the power companies do not carry storage over from one year to another, and as the present dry year comes at the end of a series of dry years, the situation is serious and is getting worse as the season advances.

The situation in the northern part of the state is represented very well by records of the Pacific Gas & Electric Co. and the Great Western Power Co. The former company reports that this year the stream flow averaged over the year has been about 66 per cent of normal. For the month of July it was 58 per cent. Storage in the South Yuba, the Mokelumne and the Stanislaus Rivers is 90, 70 and 85 per cent of normal respectively.

Stream Flow Low

The Great Western Power Co. reports a stream flow in the Feather River (2500 sq. miles of watershed) amounting to 40 per cent of normal. To be more specific, the normal flow in this stream at this time of year is 1,620 sec.-ft., the lowest flow on record previous to this year was 780 sec.-ft. and now the flow is 660 sec.-ft. Storage on the Great Western system is 47 per cent of normal or 133,000 acre-ft., as against a normal 285,000 acre-ft.

Power companies in the north expect to get through the season without a power cut, and no power administrator has been appointed there as has been the case in the South. Nevertheless the situation is not easy and idle generating plants found here and there in industrial works are being called upon to aid the power companies.

The San Joaquin valley has probably suffered more from the drought than any other part of the state. On the Kern and Kaweah Rivers only three or four out of some 35 irrigation canals are carrying any water. Last year at this time the Kaweah had a flow of 580 sec.-ft. Now it is carrying 30 sec.-ft. and is drying up rapidly. The Kern normally has a flow of 1,350 sec.-ft. in July, now it is carrying 120 sec.-ft. and there is good prospect that it will go dry.

Huntington Lake, typical of the basin from which a large part of southern California's hydro power is derived, collected 53,000 acre-ft. in the driest year heretofore (1919); this season only 17,000 acre-ft. has flowed into the lake.

World's Power Conference Held in London

Two Weeks' Sessions Devoted to International Study of Power Problems Runs from June 30 to July 12

With about 500 delegates from 39 countries in attendance the first World Power Conference was held in London from June 30 to July 12. On the program 415 papers are listed and practically all of them were presented either in title or in detail with as much discussion as time permitted. These papers when published will, it is expected, make four volumes of about 2,000 pp. each and will cover every phase of the power question from the viewpoint of engineers in all parts of the world. Necessarily, with so many papers, even with the simultaneous sessions over two weeks, a delegate could hear read and discussed only a few of the papers. Further than that, on account of the multi-lingual nature of the delegates, progress in the discussion was somewhat slow.

Purposes of Conference

The conference was initiated by the British Electrical and Allied Manufacturers' Association, to consider, as stated in its preliminary program, how the industrial and scientific sources of power may be adjusted nationally and internationally:

By considering the potential resources of each country in hydro-electric power, oil, and minerals.

By comparing experiences in the development of scientific agriculture, irrigation, and transportation by land, air, and water.

By conferences of civil, electrical, mechanical, marine, and mining engineers, technical experts, and authorities on scientific and industrial research.

By consultations of the consumers of power and the manufacturers of the instruments of production.

By conferences on technical education to review the educational methods in different countries, and to consider means by which existing facilities may be improved.

By discussions on the financial and economic aspects of industry, nationally and internationally.

By conferences on the possibility of establishing a permanent world bureau for the collection of data, the preparation of inventories of the world's resources, and the exchange of industrial and scientific information through appointed representatives in the various countries.

Technical Discussions

The scheme of the conference was first to present in as much detail as possible the power resources of various sections of the globe. This was done in papers from experts from different countries, making up a compendium of power statistics which is of value, followed by discussions on the economic aspect of power resources together with the legal and government policies. Technical discussions followed on steam generation, utilization of fuel, preparation of fuel and water power problems. Further discussion ranged from gas and fuel production, power production details to power transmission with some side excursions into the uses of power in electrochemistry and industry, transport, electrometallurgy and the few papers on such things as publicity and standardization.

The sessions were opened in rather formal fashion with speeches by the Prince of Wales and by the Earl of Derby, who was president of the conference, to which responses were made by distinguished representatives from each of the delegate countries. O. C. Merrill, executive secretary of the Federal Power Commission, responded for the United States. There were in addition to one large conference banquet, at which there were nearly 800 in attendance, a number of other banquets, luncheons and dinners by the various government delegations. In attendance there were about 150 delegates from Great Britain, 125 from the United States and about 160 from the rest of the world.

At the end of the conference a formal memorandum was adopted inviting all the participating countries to appoint permanent committees, representatives of which are to form an international committee to arrange for another such conference at a suitable time in the future. The only technical resolution adopted by the conference was as follows:

"That this conference is of the opinion that the world's most crying need today is greater production and manufacturing activity among its peoples under conditions which will promote individual prosperity and happiness, and that this can be largely achieved by the fuller development of national power resources and by the establishment of the most economical means for the general distribution and utilization of energy."

Montreal Commission Empowered to Build St. Lawrence Bridge

The construction of the long-discussed bridge from Montreal to the mainland across the St. Lawrence river is now to be authorized. Notice has been given by the Canadian government of a resolution to empower the Montreal Harbor Commission to build, own and maintain the bridge, which is to be used for general traffic including tramways. The commission is to be authorized to issue bonds to finance the project.

The battle to construct a new bridge across the St. Lawrence has been waged for years. Of late years' tourist organizations, such as the Quebec Tourist Association, and the boards of trade of the South Shore municipalities as far down as the city of Sorel, have taken the matter up with vigor, and brought all possible pressure to bear upon the government to permit the project to be executed.

Further Development on Skagit River Deferred

Seattle Council Notifies Engineers Release Will Come With Gorge Creek Plant Completion

The city council of Seattle, Wash., on June 23 adopted a resolution notifying Carl F. Uhden, engineer in charge of construction on the city's hydro-electric power project, as well as his assistants and construction crew, that their services would not be required after the completion of the Gorge Creek plant, which is the first unit of the Skagit project. At the same time a resolution was passed appropriating $150,000 for the completion of this first unit, the money to be borrowed from the light fund. In the preamble of the resolution it was declared that "in fairness to the engineers and others heretofore employed in the construction of the Gorge Creek plant, they should be informed at this time of the policy of the city in regard to future Skagit River development," and also that "it is necessary in the public interest that the Gorge plant be put into operation before plans for future development of power from the Skagit River may be intelligently determined."

Economy Move Necessary

In passing these resolutions the council made it plain that there was no intention to delay indefinitely completion of the Skagit project but merely to keep down expenses by dispensing with the engineers and employees in that department while a program for the future is being mapped out. The question of continuing the work was forced to an issue, it is stated, by the request of the chief engineer for $177,000 with which to complete the project, the $11,000,000 originally appropriated for this plant having been used up.

The city of Seattle received authority from the federal government in 1920 to proceed with the power development of the Skagit River, which is 150 mi. long and has a drainage area of more than 3,000 sq.mi. The Skagit project was then laid out to develop the upper third of the river by means of two plants, known as the Gorge Creek and the Ruby plants, respectively, and described in *Engineering News-Record*, Nov. 18, 1920, p. 994, and Dec. 8, 1921, p. 948.

As the first unit of the Gorge plant stands now, all parts of the work, including two 20,000-kw. units in the power house, are finished except the tunnel and the timber crib dam, which is to be used until the masonry dam is built. The tunnel is completed with the exception of a portion of the floor lining, which was to be finished in August and by that time the dam was to be ready also. A 100-mile wood-pole transmission line is ready to carry power to the north substation in Seattle, which is also completed. With the present installation the maximum production, with the crib dam in place, is estimated at 59,000 hp. and the minimum at 23,400 hp. With the installation of another generating unit and the erection of the masonry dam at a cost of $5,000,000 the capacity would become 112,500 hp.

Fish Interests Lose Fight Against High Dams

Power Commission Issues Preliminary Permit for Klamath Project in North California

Washington Correspondence

In authorizing a preliminary permit for the Electrometals Co., covering an important development on the Klamath River in northwestern California, the Federal Power Commission has given a significant indication of its attitude toward protests against high dams by fish interests. The preliminary permit was authorized in this instance over strenuous protests from the California Fish and Game Commission and from Representative Raker, of that state. It is the opinion of the Commission, however, that the problem of passing fish over high dams can be solved during the time it is necessary to survey the project, prepare plans and perfect financial arrangements.

The Electrometals project covers two dams in the Klamath River at which 127,000 hp. can be developed. The application is made jointly, however, with one by A. P. Seybold, which provides for a third dam at which 30,000 hp. can be developed. These applications were filed nearly four years ago. The point had been reached where definite action on their application no longer could justly be denied.

POWER USES

The development of cheap power on the Klamath is the basis for an important project for manufacturing aluminum at Trinidad, a port on the Pacific just north of Eureka. The bauxite is to come largely from British Guiana, through the Panama Canal. The matter of increased canal tolls also had weight with the Commission. W. G. Devereux, and the other backers of the Electrometals Co., have had long mining and metallurgical experience in California and Colorado and were judged to be entirely qualified to undertake such a development. The granting of the permit was urged by the San Francisco Chamber of Commerce and by all civic organizations in Humboldt County with the single exception of the canners' association.

For two years an intensive controversy over this project has raged in California. A thorough study of the proposed development by the Division of Water Rights of the Department of Public Works of California resulted in a decision to grant the necessary state rights for this project. The Fish and Game Commission has carried the matter to the courts but the Federal Power Commission saw no reason to withhold the preliminary permit, after the state rights had been granted.

Representative Raker, at the last session of Congress, proposed an amendment to the water power act, which would remove the Klamath River from the jurisdiction of the Commission. The House committee acted adversely on the Raker bill. A similar measure was lost in the California legislature when the Senate committee voted it down 14 to 1. The Fish Commission then began circulating a petition to have the Klamath River made a state fish preserve on which no developments could be made. The proposal is to put the question to the people at the November election as a referendum measure. The Federal Power Commission was requested to await the outcome of the November elections, but district officials of the Forest Service advised the Commission that little progress was being made in obtaining signatures for the petition.

The Electrometals Co. has submitted a large amount of evidence intended to show that fishways can be built which will allow the passage of salmon. While the Commission is fully aware of the much greater value of the power possibilities of such streams as the Klamath and the Columbia, as compared with the value which they have to the fish industry, there is no disposition to interfere with the migrations of salmon.

John H. Dunlap Still Very Ill

John H. Dunlap, secretary, American Society of Civil Engineers, who was seriously injured in a train wreck June 30, at Buda, Ill., is still in a serious condition, according to word brought back July 22 by C. E. Beam, assistant secretary. Since the accident he has been at the Presbyterian Hospital, Chicago. Dr. Arthur Bevan, who made the latest examination in consultation with Dr. Dean Lewis, in charge of Mr. Dunlap's case, considers his condition very grave. Mr. Dunlap has failed to regain control of all voluntary muscles from the chest down. His removal from the Presbyterian Hospital, the doctors consider is decidedly inadvisable.

T. L. Condron, director, and C. E. Loweth, past-president, have been in daily contact with Mrs. Dunlap and on occasion have spoken with Mr. Dunlap. Mr. Beam, who has just returned from Chicago, reports that Mr. Dunlap was entirely rational on Sunday, but early in the week temperature developed and the report was "not so well."

Girand Enjoined From Building at Diamond Creek on Colorado

A permanent injunction prohibiting James B. Girand from building a dam at Diamond Creek on the Colorado River has been issued by the Federal Judge at Prescott, Ariz. A temporary injunction was granted in March in an application filed by the government, nearly three months after work had been started at the site by the Girand forces despite the fact that the Federal Power Commission, in Oct. 1923, had declined to issue a license for the construction.

At the time the commission took this action it declared that its decision not to issue the license would have no effect on the priorities established by Mr. Girand under his preliminary permit of July 19, 1921. During the hearing it became evident that the failure of Arizona to ratify the Colorado River compact was the foundation of the trouble over the Girand license, that the government was not willing to grant any licenses for construction until a policy concerning the control of the river had been decided upon.

WASHINGTON NOTES

Favorable Weather and a favorable stage of the river are allowing the work at Muscle Shoals to proceed rapidly, it being well in advance of schedule. Engineer officers are confident in predicting that this job will have been completed and power will be ready at the end of this fiscal year.

Present Plans Provide for the completion of the Ohio River project in 1929. There is every reason to believe that a schedule which just has been prepared to that end can be carried through successfully. By providing a minimum depth of 9 ft. between Pittsburgh and the mouth of the Ohio, it is expected to become the Rhine of America.

Apparently the Difficult engineering problem involved in the maintenance of deep water through the Southwest Pass of the Mississippi River has been solved. A uniform depth of 35 ft. has been secured. The river is keeping this channel scoured and it is believed at the Corps of Engineers that this depth can be maintained indefinitely. Ships are not being encouraged to use this Pass as there still is much work to do in the reconstruction of the jetty system and in widening the channel.

Those in Charge of the Rio Grande Irrigation project point out that the Elephant Butte dam again is in a position to justify in a single season the $6,000,000 spent for its construction. It is contended that this dam on several previous occasions has stood between the farmers of the region and ruin, and has protected El Paso from flood damage. Despite the lack of rain elsewhere, the Rio Grande was in flood this year and all but caused the reservoir to spill—a level hitherto not even approximated.

A Promising Movement is under way among the water users on the Boise reclamation project to take over the enterprise under a contract similar to that under which the Salt River project is operated. A form of contract has been drafted. Dr. Ellwood Mead will visit the project to discuss the proposal. The Boise project is one of the largest which has been developed by the Bureau of Reclamation. It includes the Arrowrock dam, 349 ft. high. The project has maintained a large agricultural production.

A Policy Which Will Be Emphasized by Major-General Harry Taylor, the new Chief of Engineers, during his administration, will be the elimination of red tape. When the public must come to a government agency for a permit or special authorization, he feels that every effort should be made to reach the earliest possible determination of the application, thereby avoiding charges of government inefficiency. During his administration, he will insist that nothing be allowed to delay unnecessarily reports upon which depend the issuance of water power or the various other permits which the public must secure.

City Wins Odd Damage Suit

Judge D. T. Hartwell in the Williamson County Circuit Court at Marion, Ill., July 15 held that a culvert cover is not a sidewalk and that a person putting it to such use does so at his own risk. He so decided in the case of Louis Williams of Johnston City, Ill., who sued that city for $5,000 damages for injuries sustained while walking across a board covering a culvert. Williamson was smoking a pipe and the board flew up striking him in the face, breaking the pipe stem and driving an inch or more of it into his tongue, requiring an operation.

Ohio County Surveyor and Road Contractor Accused of Fraud

Jack Weaver, county surveyor of Summit County, Ohio, one of his inspectors, T. E. McShaffrey, the contractor and one of the latter's foremen have been indicted by the grand jury, charging fraud in the construction of a portion of Portage Lakes Drive, an improvement included in the 1922 construction program. The section is 2.24 miles long, and of 16-ft. wide asphaltic concrete on slag-macadam base. It was built with 6 in. of base or less, instead of 8 in. called for in the specifications, according to test borings made by the state highway department. Mr. Weaver has resigned, and R. E. Willems has succeeded him as county surveyor. Though no charges against Mr. Weaver's subordinates were made, except against the one inspector involved on the Portage Lakes job, Mr. Willems has established an entirely new engineering organization. Mr. Willens served as deputy county surveyor in a previous administration.

Mr. Weaver is credited with having expressed wonder at the job not measuring up to specifications. He gives as a possible reason for it the large size of the construction program for 1922, and the fact that he was unable to supervise but a portion of it personally.

At the time Mr. Weaver first ran for the office of county surveyor in 1920, the Engineering Society of Akron actively opposed his candidacy on the ground that he lacked experience and ability in engineering lines requisite to the job.

Western Society Committees Meet

More than 75 members of committees and officials of the Western Society of Engineers met July 16 to discuss the proposed activities of the society for the coming year. Appointments were made this year within ten days after the new officers were installed June 9. Reports presented from 29 section and committee chairman indicate most of them have had at least one meeting to plan the year's activities. Last year nearly 10,000 persons attended all of the meetings, of which 35 were technical meetings attended by 6,200. Thirty-eight technical meetings are planned this year.

The library committee reported 459 calls in two months, said to be about one-third the service rendered by the library of the national engineering societies in New York. The empolyment department has ten applications to one position open.

Further Tube Extensions Planned for London, England

An important development of the underground railway in south London is about to be carried out in the form of an extension to the Hampstead tube from its present terminal at Charing Cross to Kennington, via Waterloo. At Kennington the Hampstead line will be connected with the City and South London Ry. by communicating passages between the station platforms. This will be the only tube station in London having platform interchange systems between the two converging subway lines. The new line will be about two miles in length, and it is hoped to have it completed by the end of next year.

The new Kennington extension will provide an additional route between Waterloo and both south and north London, thus materially reducing the congestion that now occurs on the Waterloo line during the rush hours. In the last ten years Waterloo traffic has increased from 6,500,000 to over 12,000,000 people annually.

The Kennington extension will be the fourth railway built under the Thames River between the Tower and Westminster.

Fires Sweep California Forests

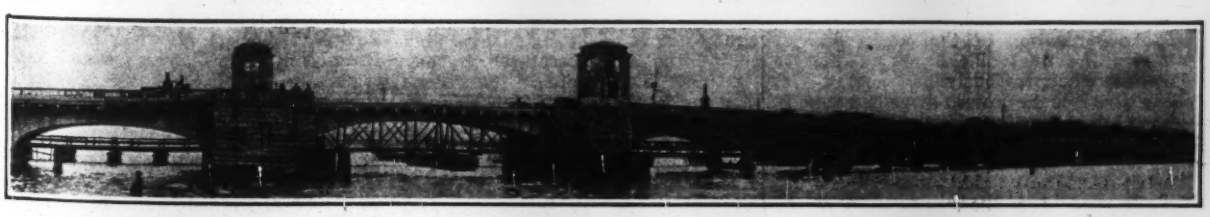
Forest resources of California are threatened by the most serious fire menace in the history of the state because of the unusual dryness of grass and brush due to drought and warm weather of the present season. The number of fires this year already exceeds 900 and more than two months of the hazardous season are still ahead. At times as many as 1,800 fire fighters have been at work under the direction of U. S. Forest Service officials. On July 20 about 150,000 acres had been burned over. The national forests are being closed to campers and the district forester has asked for federal troops to patrol where the danger is greatest.

Part of Contract Between Newark and Water Company Voided

That part of the contract of 1889 between the city of Newark and the East Jersey Water Co. which prohibited the sale of water by Newark outside of its own limits and those of Belleville, East Orange, South Orange and Clinton was declared void by Vice-Chancellor Church on July 14, because in restraint of trade and thus against public policy, and also because even if the controverted part of the contract were legal the company could sue to collect damages for its violation. The suit was brought by the company named (now the Passaic Consolidated Water Co.) to prevent Newark's selling Pequannock water to Kearney and Nutley.

In effect, the court held that when Newark took over the works built for it by the East Jersey Water Co., the city had a right to make such use of the water developed by those works as it saw fit and that Newark, with surplus water and other communities as possible customers, could not be deprived of the right of trade. This restriction had been a subject of bargaining by the company as regards Bloomfield, Glen Ridge and Montclair, the company permitting Newark to sell water to Bloomfield for a consideration and agreeing to a waiver of the prohibition as regards Montclair in the contract for the sale of the distributing system in Montclair to that town consummated early this year.

Concrete Arch Bridge of 27 Spans Crossing Severn Is Opened



A concrete bridge of notable length has recently been opened to traffic in Maryland. The bridge crosses the Severn River, and is a link in important highways connecting Baltimore with Washington and Annapolis. The bridge has a length of 1,827 ft., composed of 27 spans, each of which is 65 ft. in length in the clear. The draw opening is 75 ft. The width of the bridge is 22 ft. of clear roadway, with a 6-ft. sidewalk on each side. The average clearance of the arches above mean low water is fifteen feet. Improved mechanical equipment makes it possible to open or close the draw in 60 seconds. The accompanying illustration shows slightly more than half of the bridge. The draw is in the center of the structure. Total cost of the bridge was $800,000.

Contracts Let for Philadelphia Bridge Approach Steel

Two additional contracts for the Delaware River Bridge, providing for construction of the structural metalwork of both Philadelphia and Camden approaches, were awarded by the Delaware River Bridge Joint Commission on July 21 to the American Bridge Co. The contracts provide for the column supports of the steelwork and for the trusses, girders, and floor systems of the approaches. The floor slabs are not included. The main material of the trusses and certain other portions of the work are of silicon steel, and the other parts of the work are all of carbon steel. Total tonnage in the two approaches exceeds 24,000 tons.

Bids for the two contracts were received by the Commission in two forms. Form "A" was for the work on either contract alone, and Form "B" was for the work on each, provided the bidder was also awarded the contract for the other approach. The American Bridge Co. was the low bidder with a bid upon Form "B." Its bid for the Philadelphia approach was $1,511,850, and for the Camden approach $1,793,650. The Bethlehem Steel Co. and McClintic-Marshall were the other two bidders.

Latin Americans Return Home After Road Trip in U. S.

With a complete picture of highway transport conditions in the United States as a background for their action, delegates to the Pan-American Highway Commission have sailed for their respective countries. Before they left, however, the Pan-American Confederation for Highway Education was organized and a tentative program formulated for the first Pan-American highway congress to be held in Buenos Aires next spring.

In each of the nineteen Latin-American nations represented on the tour will be formed a body patterned after the Highway Education Board of the United States, the parent organization, all of which are united in the Pan-American Confederation for Highway Education. In the opinion of those participating in its organization there is thus formed an international organization destined to have a far-reaching effect upon transportation facilities of the American continent, and a foundation upon which the structure of continued friendly relations can be even more firmly established.

The organization of the confederation was the final official act of the delegates, who previously had submitted to Dr. Leo S. Rowe, director-general of the Pan-American Union, a tentative program for the first Pan-American Highway Congress. Dr. Rowe, Thomas H. MacDonald, chief of the U. S. Bureau of Public Roads, J. Walter Drake, assistant secretary of the Department of Commerce, and other government officials express the opinion that the entire trip of the commission has resulted in a great stimulus to highway transport activities, both in this country and in those represented by delegates.

Proposed Canadian National Ry. Construction Reduced

Out of the 26 bills providing for the construction of branch lines and extensions of the Canadian National Ry. system passed by the House of Commons, the Senate has passed 19 and rejected seven. These seven, most of which are located in Saskatchewan, represent a mileage of 378 out of the total in the year's program of 965, while the estimated cost of the lines rejected is a little over $12,000,000 or almost half of the $28,000,000 in the original program.

Highway Fellowships Offered at University of Michigan

The Board of Regents of the University of Michigan will award before Nov. 1 the following fellowships: Two Roy D. Chapin fellowships, one in highway transport and one in highway engineering; and two Detroit Edison fellowships in highway engineering. These four fellowships are for graduate study only leading to the degree of Master of Science or Master of Science in Engineering. Applications for fellowships should be sent to Arthur H. Blanchard, 1016 East Engineering Building, University of Michigan, Ann Arbor, Mich.

From December 1924 to March 1925 the University of Michigan will offer nineteen professional short period courses in highway engineering and highway transport, each course to consist of thirty lectures, to be given in a period of two weeks and to count as two hours credit toward the master's degree.

Newlands Project Badly in Need Of Water

The Fernley-Bench section of the Newlands reclamation project is facing a particularly serious situation through lack of water. In view of the demand that permission be given to pump water from Lake Tahoe for the use of the project, Secretary of the Interior Work has ordered Dr. Ellwood Mead, the Commissioner of Reclamation, to make a personal investigation of the situation.

The Fernley-Bench section of the Newlands project gets its water from the Truckee River, which rises in Lake Tahoe. The drought has lowered the lake level to a point below the rim of the outlet. The water users below want large pumps installed so that enough water may be made available to curtail the crop losses which they are facing. The proposal to reduce further the level of Lake Tahoe is opposed by riparian owners. The whole situation is encompassed by many difficulties. The lake is navigable and is an interstate body of water. Even if the consent of the riparian owners and the navigation interests could be secured, there is doubt whether the pumping equipment could be installed in time to prevent the agricultural losses. A further difficulty is presented by the fact that the canals of private owners and of power plants lie above a government canal.

Random Lines

Long—Spann.

Mrs. Fannie Long announces the engagement and approaching marriage of her daughter, Agnes, to Mr. Frank G. Spann of Amarillo, Texas, the wedding to take place in late summer.

—Memphis *Commercial Appeal.*

* * *

Referred to the Committee on Nomenclature.

A new departure in dam construction is being attempted by the Water Bureau in the building of the new Fairmount Park dam, according to the Philadelphia *Public Ledger.*

"Heretofore, it has been the custom to erect a new dam in front of the old and then to tear out the old. In building this new dam out at Fairmount Park, it was decided to try out a new system. Instead of building the new one as a buttress to the old they are letting the old keep the water from the new until it is completed. Then the greater part of the old will be left standing. When the dam is completed, enough of the top of the old dam will be torn off to allow the water to flow into the new.

"The work is being done under the direction of the engineers of the Water Bureau but Seeds and Durham have the contract. *It will be what is technically termed a coffer dam.*"

The italics are ours.

* * *

"(Laughter)"

The Right Hon. the Earl of Derby, K. G., was the toastmaster at the formal banquet of the World Power Conference in London on June 30. His opening remarks are quoted in the London press, as follows: "Since the war there have been so many conferences (*laughter*) . . ." We were a little puzzled at that "(*laughter*)." There didn't seem to be anything more than moderately humorous in the honorable gentleman's opening sentence. In fact, considering that probably three-quarters of his audience were British and nine-tenths of the remainder couldn't understand English, we rather doubted that there was any merriment at all. Then we looked at the menu and found listed under the heading *Vins*, the following: "Punch, Sherry, Flora Blanche, Chateau Mouton Rothschild, Pommery and Greno 1915, G. H. Mumm Cordon Rouge 1913, Port Martinez 1908, 1868 Brandy, Liqueurs, Whiskey and Minerals."

Now all is clear; except that we believe the official stenographer was somewhat euphemistic in that term "(*laughter*)." What he should have written was probably "(*Giggles, alarums and excursions, cries of 'attaboy Earl' from the American contingent, clatter of chairs as two delegates from mid-Europe are carried from room amid breaking of glasses knocked off table by target practice with dinner rolls.*)" But then probably five years of dry banqueting has dulled our remembrance of the earlier days.

Anybody Seen Lacefield?

Ten years ago Fielding Lacefield, who is supposed to be doing bridge work on his own hook in the Gulf section or in California, left home and has not been heard from since. His father, Buck Lacefield, and mother, who live in Carrollton, Ky., are getting along in years and have been unsuccessful in locating him. Matters relating to an estate, as well as other family affairs, await his return.

Cecil Hawley, a contractor of the firm of Ellis, Smeathers & Hawley, who happened to have a contract in the city, was appealed to by Mr. Buck. Mr. Hawley felt that *Engineering News-Record* readers might know Mr. Lacefield and report his address to his parents.

City Will Build Houses To Sell To Homeseekers

The city of Cohoes, New York, through its common council, has voted a bond issue of $150,000 to buy lots, build houses and sell them to homeseekers. One and two-family houses, patterned after the California bungalow type, will be constructed to sell from $3,000 to $3,500. It is planned to sell the houses on the installment basis. At the time of the passage of housing legislation by the New York State Legislature the question of state-wide municipal ownership of dwellings to be rented at reduced prices to citizens was discussed, but for a city to construct houses and sell them at cut prices to relieve the housing condition is regarded as the first attempt of its kind. It is planned to start the construction of twelve houses shortly.

Authority for such action is said to vest in the Home Rule amendment to the New York State constitution adopted by the people at the general election last fall.

Water Needs of Paris Will Soon Be 1,000 M.G.D.

Special Correspondence

A voluminous report has just been issued by the municipality of Paris showing the necessity of providing immediately for an additional water supply. The short but urgent conclusion which compels attention is that within a decade, perhaps sooner, Paris will need 1,000 U. S. m.g.d. of water. The present supply, when there is not a shortage created by drought or other cause, scarcely exceeds 500 U. S. m.g.d.

Allied with this question is the prospect of establishing a port along the Seine which shall have a sufficient depth of water to allow small deep sea steamers to come to the wharf. This precludes the possibility of robbing the upper reaches of the Seine of too great a volume of water for other purposes.

The upper Marne River and still more distant sources are ultimately to be linked up with the present water-supply system and the work of installation will be vast and costly. It is none the less urgent for that.

Personal Notes

C. J. OUELLET & SONS, general contractors and architects of Boston, Mass., have opened up an office at 349 West Main St., Meriden, Conn. Mr. Ouellet has been in contracting work in Boston for over 27 years.

WYNKOOP KIERSTED, JR., assistant engineer with Fuller & Maitland, Kansas City, Mo., has been appointed first assistant engineer to the Fire and Water Board.

D. K. CALDWELL, recently county engineer at Tyler, Texas, has been appointed engineer in charge of highway construction in Precinct 1 of Bowie, Texarkana County, Texas.

H. C. BREIDERT, who has been contracting engineer at the Chicago office of the Fort Pitt Bridge Works, has been transferred to the main office in the Oliver Building, Pittsburgh, Pa., as chief contracting engineer. His successor as contracting engineer in Chicago will be E. K. ADAMS.

MORRIS BIEN, assstant commissioner of the U. S. Bureau of Reclamation, has been relieved of his duties in connection with that office by Secretary of the Interior Work as part of a so-called economy move. Mr. Bien has been with the Reclamation Service since its inception. He has served as supervising engineer of land and legal matters, as counsel, as assistant director and as assistant commissioner. He has opened an office in Washington, D. C., and will conduct a consulting practice.

H. A. STRINGFELLOW, of Kiersted & Stringfellow, consulting engineers, Kansas City, Mo., has been made chief engineer of Compania del Aqueducto de Barranquilla, Barranquilla, Colombia, S. A. The company, which is municipally controlled, has obtained Mr. Stringfellow's services for a two-year period for the purpose of planning the reconstruction of the entire system, including a new intake, pumping station and filters, so that immediate improvements while not large will fit in with the ultimate system.

H. S. COMLY and J. C. MCLEOD have been advanced to the position of division engineer with the California Highway Commission. Both men have been acting division engineers for several months, Mr. Comly being in charge of Division II at Dunsmuir, and Mr. McLeod directing the work in Division X, with headquarters in Sacramento. Mr. Comly has worked up through the ranks in the California Highway Commission, having started in 1912 as chief of party. Mr. McLeod came to California recently from Oregon where he has been for several years with the Oregon State Highway Department.

Engineering Societies

Calendar

Annual Meetings

AMERICAN SOCIETY OF SANITARY ENGINEERING, New York; Annual Convention, Philadelphia, Pa., Sept. 9-12, 1924.

NEW ENGLAND WATER WORKS ASSOCIATION, Boston, Mass.; Annual Meeting, Rochester, N. Y.; Sept. 30 to Oct. 3.

AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS, St. Petersburgh, Fla.: Annual Convention, Boston, Mass., Sept. 29-Oct. 3, 1924.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York; Fall Meeting, Detroit, Oct. 23-25, 1924.

Obituary

CHARLES J. JONES, chief engineer and superintendent of way and structures of the Chicago, Aurora & Elgin Ry., died at Wheaton, Ill., on July 10. Mr. Jones, who was 62 years of age, was formerly chief engineer of the Lorain Steel Co., but resigned in 1899 to become chief engineer for Cleveland interests which purchased local and interurban electric railways in and around Aurora and Elgin, Ill., and which later built the double-track third-rail high-speed interurban line between these cities and Chicago. Mr. Jones was in charge of the surveys and construction of that road, and was for a time both chief engineer and superintendent in charge of operation.

WILLIAM LEE KELLY, president of the Kelly-Atkinson Construction Co., of Chicago, died July 13, at a hospital in Cincinnati, Ohio, as the result of an accident the previous day. While on his way from the hotel to the railroad station he stepped upon a sidewalk grating, which gave way, precipitating him into the basement and fracturing his skull. Mr. Kelly was 59 years of age; he was born in Waukegan, Ill. He early became interested in bridge building and construction work and played a prominent part in the building of the Great Northern and Northern Pacific and other western railroads. The company which Mr. Kelly founded has built many notable steel structures, among them the bridge over the Mississippi River at Thebes, Ill. During the war he organized and became president of the Mobile Shipbuilding Co., of Mobile, Ala., which built wooden and steel vessels for the U. S. Shipping Board.

ELISEE G. LAVERDRUE, contractor, Ottawa, Can., died recently at his home in that city, aged 83 years. Mr. Laverdrue was born in St. Lin, Que., but had lived in Ottawa since 1864. He conducted a hardware store for thirty years and then established a general contracting business. He constructed the lift-locks at Peterboro in 1896; he also installed the water-works and the sewerage system in Hull, Que.

From the Manufacturer's Point of View

A Point of Contact Between Maker and User of Construction Equipment and Materials

Equipment Needs Care at End of Job

R. E. Brooks, New York Distributor, Gives Practical Suggestions for Increasing Life of Plant

FOR the care of equipment at the end of a job or at the end of the season R. E. Brooks, of the R. E. Brooks Co., New York, construction equipment distributor, has offered the following suggestions:

The machine should be thoroughly cleaned and all accumulations of concrete and dirt completely removed.

All bearings should be given careful inspection and taken up where necessary. Wherever bearings cannot be made tight by removing shims, they should be rebabbitted.

All missing and broken grease cups should be replaced.

Cables should be thoroughly cleaned with kerosene or light oil and then covered with a heavy grease having a tar body. Badly worn cables should be replaced.

Gasoline Power

To clean the water jacket of a gasoline engine, take 2 gal. of hot water, to which has been added all the common washing soda that the water will dissolve. Draw off enough water to accommodate the solution and place it in the engine and let it run for a few minutes. Then drain the engine and flush out the water jacket thoroughly with fresh, clean water. Grease and oil the inside of cylinder, the piston and all shafts and bearings.

Steam Power

Drain the boiler and, when dry, remove the safety valve. Pour in about a gallon of cylinder oil, then fill the boiler with water. After completely filling the boiler, drain out all the water again. This will leave a coating of oil on the inside of the tubes and shell. Replace the safety valve.

Paint the inside of the fire box with heavy oil, remove the hood from the boiler and brush the tubes with a wire brush; swab the inside of the tubes and hood with an oiled rag or waste; paint the outside of boiler and hood with asphaltum paint; cover the top of boiler with canvas, tying same securely around the boiler.

After any machine has been inspected and overhauled, coat it with heavy oil or paint. If possible, store the machine in a building or cover it with a tarpaulin to protect it from the weather.

What has been said is common knowledge to most experienced contractors, but these recommendations may inspire someone to give this important subject of the care of contractor's plant a little closer supervision.

This subject of equipment, with its attendant costs of ownership, may be a contributing cause of the great difference in the bids on road jobs these days where it is not uncommon to find as much as $30,000 or $40,000 difference between the high and low bidders on a $150,000 or $200,000 job.

Architectural Terra Cotta

Bookings of architectural terra cotta by 26 manufacturers, who produced about 95 per cent of the architectural terra cotta made in 1922, have been reported to the Department of Commerce for the first five months of 1924 and are shown below in tonnage and in value. Values exclude freight, cartage, duty and setting charges.

BOOKINGS OF ARCHITECTURAL TERRA COTTA

Month, 1924	Net Tons	Value
January	16,240	$1,561,518
February	3,227	1,467,539
March	12,022	1,316,553
April	13,011	1,570,117
May	10,171	1,229,551

According to reports for the Census of Manufactures, 1923, the establishments engaged primarily in the manufacture of architectural terra cotta in that year produced 134,810 tons of this product, valued at $16,827,776, or an average of $124.27 per ton. Twenty-seven of these establishments also reported other products, such as brick and tile, of a total value of $15,517,233, the value of their terra cotta production being 90 per cent of the total.

In 1922 the total value of all products reported by the establishments which manufactured architectural terra cotta was $14,981,916, the value of their terra cotta production being 82 per cent of the total. Three establishments have not yet submitted complete reports for 1923, but the tonnage and value of their terra cotta production are included in the figures given above and in the statement below.

The production statistics for 1923, 1922, and 1921 are summarized in the statement below. The figures for 1923 are preliminary and subject to possible correction when the final reports are published.

TERRA-COTTA PRODUCTION, 1921-1923

	Total
No. of establishments:	
1923	30
1922	28
1921	27
PRODUCTION	
Value:	
1923	$16,827,776
1922	12,409,543
1921	9,068,473
Tonnage:	
1923	134,810
1922	107,224
1921	68,360
Average value per ton:	
1923	$124.27
1922	115.73
1921	132.66
Per cent increase:	
Quantity:	
1922-23	26.3
1921-22	56.9
Value:	
1922-23	35.6
1921-22	36.8

Durgin Succeeded by Hudson as Simplification Chief

William A. Durgin, who for two and a half years has been at the head of the Division of Simplified Practice of the Department of Commerce has left his government activity to resume his former post with the Commonwealth Edison Co. of Chicago, from which he was borrowed by Secretary of Commerce Hoover when the latter established the Division of Simplified Practice to help industry eliminate waste through the reduction of excess varieties. He is succeeded by Ray M. Hudson who has been assistant chief of the division since it was created. Mr. Hudson, before coming into the division, was for some years connected with the automotive industry and was formerly with the Franklin Automobile Co. of Syracuse, N. Y., and later with the Holt Manufacturing Co., of Peoria, Ill.

Under Mr. Durgin's direction a large number of industries have made a thorough study of their production and sales with the co-operation of the Division of Simplified Practice, and the results have been placed before groups of producers, distributors and consumers for action. As a direct result of this co-operation, which was done without police or inquisitorial powers of government, the division assisted some thirty industries to make reductions of excess varieties ranging from 60 to 90 per cent. Out of this reduction, the groups affected report more and better business than ever before, lower production costs, decreased sales expense, smaller inventories, decrease of seasonal employment, broader markets, quicker turnover of business, and better service to the consumer—along with lower prices in many cases.

Business Notes

WALLACE & TIERNAN, Newark, N. J., completed last month what is claimed to be the largest single shipment of chlorinators for water sterilization ever made. A total of 35 vacuum type chlorinators were delivered to the water department of the city of Chicago in connection with an increase in the chlorinating capacity of the municipal pumping stations. The order for the equipment was executed in 18 working days after the Commissioner of Public Works of Chicago had authorized the company to proceed.

CHICAGO PNEUMATIC TOOL CO., New York, announces the opening of a branch office at 210 So. Jefferson St., Dallas, Texas; J. O. Bailey is in charge, reporting to the New Orleans branch.

HERMAN LEMP, engineer in charge of the internal combustion engine engineering department of the General Electric Co., has resigned to join the Erie Steam Shovel Co., Erie, Penn.

GENERAL ELECTRIC CO., Schenectady, N. Y., reports an unusually large order for flow meters for the new North Side sewage treatment plant of the Sanitary District of Chicago. This con-

tract includes 81 electrically operated flow meters; three are for sewage, using 84-in. Venturi tubes; 36 are 30-in. sewage meters using flow nozzles; the rest are all-air flow meters using flow nozzles, 36 of 16-in., three 18-in. and three 6-in. These air flow meters are for measuring the air used in the sewage treatment. A record of the ratio of air flow to sewage flow in each aeration tank will be maintained by 36 ratio meters.

ROME WIRE CO., Rome, N. Y., announces the opening of a sales office with a complete warehouse stock at 1200 West Ninth St., Cleveland. C. R. Evans, district manager, will be in charge.

INDUSTRIAL WORKS, Bay City, Mich., announce the appointment of Ridenour, Seaver & Kendig, 773 Ellicott Square, Buffalo, N. Y., as their representatives in the Buffalo district.

DE LAVAL STEAM TURBINE CO., Trenton, N. J., has recently formed a Pacific Coast sales organization under the direction of William Pullen, covering California, Oregon, Washington, and parts of adjoining states. There will be district offices located at 617 West Seventh St., Los Angeles, in charge of Ivan E. Goodner; at 531 Rialto Building, San Francisco, in charge of Mr. Pullen, assisted by Eck Baughn and Charles P. Markley; and at 1306 L. C. Smith Building, Seattle, in charge of James G. Osborne, assisted by F. A. Hurlbut.

HARLEY A. WADSWORTH took over the concrete products work of the Portland Cement Association in the Southern California and Arizona district, with headquarters in Los Angeles. Mr. Wadsworth has been a member of the association's staff at Los Angeles headquarters for a number of years. His field will cover the promotion of practically all kinds of concrete work except paving.

BEN W. BEYER, JR., of New York, formerly sales engineer with the Union Special Machine Co., Chicago, is now with the New York branch office of the Industrial Works, Bay City, Mich., as district sales engineer.

FERRO PRODUCTS CO., Brooklyn, N. Y., which has been in operation as a partnership since 1916 in the manufacture of vats, tanks, bins, chutes, pans, stair risers and treads and various products made from sheet steel, has been incorporated under the name of Ferro-Co Corporation and will continue the business at the old address, Wythe Ave. & North 13th St., Brooklyn, N. Y. Howard Fitzpatrick has sold his interest in the old partnership. His former partner, Everett P. Larkin, is vice-president and treasurer of the new corporation, and A. D. Mellor, formerly of Mellor & Hamburger and secretary of the Supro Building Products Corporation, is president.

HENRY THEOBALD, president of the Toledo Scale Co., died at his home in Toledo, Ohio, last week. He was 59 years old. After a service of 17 years with the National Cash Register Co., where he became general manager and chairman of the executive committee, he bought a controlling interest in the Toledo Scale Co.

Equipment and Materials

Weed Killing by Steam on the Cuba Northern Ry.

SUPERHEATED steam is the destructive agent employed in a weed-killing machine which has been put in service on the Cuba Northern Ry. in order to reduce the work and cost of keeping the track clean in a tropical climate where vegetation grows thick and fast. This machine, shown in the accompanying view and weighing about 80 tons, consists of a steel underframe mounted on a pair of standard-gage car trucks and carrying a boiler and steam spraying apparatus. The boiler is of the locomotive type, designed for 200 lb. working pressure and is equipped with a superheater. Draft is furnished

by a blower consisting of a ring of steam jets in the smokebox. About 2,500 gal. of water are carried in the side tanks and 500 gal. of fuel oil in the rear tank.

To distribute the steam there is a group of ¾-in. pipes which are perforated on the underside and are mounted in a frame 10x10 ft. placed between the trucks and riding on four 10-in. wheels. This part of the apparatus, known as the grid, is made in three sections, one between and the others outside of the rails. Separate supply pipes with stop valves serve the three sections, so that the distribution of steam can be regulated from the cab. When in operation a curtain of heavy canvas is hung outside of the grid to confine a volume of hot steam within the enclosed space.

The weed-killing machine is pushed slowly along the track by a locomotive, the best results being obtained when the speed does not exceed about two miles an hour. The annual cost of destroying weeds in this way on the Cuba Northern Ry. is given at $13.92 per mile, as compared with $82.50 for weeding by hand. The steam spraying apparatus is made under the patents of the Dean Williams Destroyer Co., Little Rock, Ark., and the machine described above was built by the Baldwin Locomotive Works, Philadelphia, Pa. J. J. Piad is chief engineer of the railway.

New 1½-Ton Truck Model Has Drive-Shaft Brake

For hauling what is commonly termed an "average load," the Republic Motor Truck Co., Inc., Alma, Mich., announces the new Model 10-F of 1½ tons capacity. The improvements in this truck include a new type pressed steel radiator; drum type headlights; wheel base considerably lengthened to assure a better load distribution, easier riding qualities and greater tire economy; and increased strength and durability due to a deeper, thicker chassis frame.

The new model is equipped with a drive shaft brake which, it is claimed, will stop the truck in its own length at maximum governed speed. The brake, which for the first time has been placed on a truck of this size, consists of two heavy contracting shoes lined with woven wire asbestos and operating on a large brake drum mounted on the drive shaft at the intermediate bearing bracket. This design insures positive and equalized braking effort on all wheels.

Publications from the Construction Industry

Force Feed Lubrication — MCCORD RADIATOR & MFG. CO., Detroit, discusses the economy of force feed engine lubrication in a 23-p. pamphlet containing illustrations of its lubricator adapted to small steam engines, oil engines, gasoline engines, air compressors, steam pumps and auxiliaries. The publication contains a complete set of overall dimensions, price lists and description of the lubricator. A supplementary pamphlet shows the application of the force feed lubricator to steam shovels, cranes and dredges.

Coal and Ash Handling Machinery—JEFFREY MANUFACTURING CO., Columbus, has just issued a new 212 page catalog (No. 385) featuring its coal and ash-handling machinery for power houses. In addition to complete descriptions of the company's equipment, together with photographs of typical installations, the catalog contains useful design data on the selection of equipment, its size, capacity, horsepower required, etc. There are separate chapters on each standard type of conveyor, including pivoted buckets, V-buckets, scraper conveyors, belt conveyors, steel apron conveyors, spiral conveyors, track hoppers and feeders, skip hoists and portable loaders.

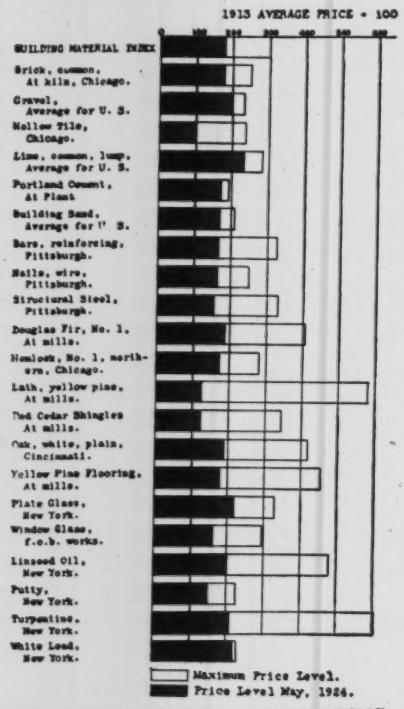
Structural Pipe Fittings—WESTINGHOUSE ELECTRIC & MANUFACTURING CO., East Pittsburgh, Pa., in a 36-p. two-color publication announces a new and complete line of interchangeable pipe fittings for structural work. The publication, which is known as Circular 1676, describes these fittings and gives their application to such work as the erection of outdoor substations, switching equipment, switchboard frames, racks, railings, fences, etc. It contains a large number of photographic illustrations, supplemented by dimensional drawings, making the publication useful as a reference book for the designer of such structural work. An adjustable insert for fastening machinery or other equipment to concrete floors, walls or ceilings, another new Westinghouse product, is also described and pictured in the publication.

Business Side of Construction

FACTS AND EVENTS THAT AFFECT COST AND VOLUME

Trend of Wholesale Prices Downward Since Late in 1923

The index number compiled by the Bureau of Labor Statistics, which includes 404 commodities or price series, has shown a gradual downward trend since late in 1923.


1913 AVERAGE PRICE = 100
BUILDING MATERIAL INDEX
Brick, common, At kiln, Chicago.
Gravel, Average for U. S.
Hollow Tile, Chicago.
Lime, common, lump, Average for U. S.
Portland Cement, At Plant
Building Sand, Average for U. S.
Bars, reinforcing, Pittsburgh.
Nails, wire, Pittsburgh.
Structural Steel, Pittsburgh.
Douglas Fir, No. 1, At mills.
Hemlock, No. 1, northern, Chicago.
Lath, yellow pine, At mills.
Red Cedar Shingles At mills.
Oak, white, plain, Cincinnati.
Yellow Pine Flooring, At mills.
Plate Glass, New York.
Window Glass, f.o.b. works.
Linseed Oil, New York.
Putty, New York.
Turpentine, New York.
White Lead, New York.
Maximum Price Level.
Price Level May, 1924.

WHOLESALE PRICES OF BUILDING MATERIALS

This number was 147 for May, compared with 148 for April and 156 for May, 1923. Decreases in farm products and metals were chiefly responsible for the drop in the general price level. In the food group increases offset the declines, leaving no change in the general food price level.

The building materials index was 229.7 in April, 1920; 182.1 in March, 1924; 181.6 in April, 1924, and 180.3 in May of this year. The *Engineering News-Record* Construction Cost Index Number was 265.2 in April, 1920; 224.7 in March, 1924; 221.6 in April, 1924, and 222.3 in May of the current year. It will be noticed that the *Engineering News-Record's* Cost Index is considerably higher than that of the Bureau, owing to the fact that the former includes the cost of labor.

Although the general building materials index showed a drop of 1.3 points in May, 1924, there were slight gains in three of the twenty-one materials from which the general index number was compiled.

Pittsburgh Plus System Abolished

Abandonment of the Pittsburgh plus system has been ordered by the Federal Trade Commission in accordance with its decision rendered July 22, against the U. S. Steel Corporation and its subsidiaries.

It is held that this method is in violation of both the Federal Trade Commission Act and the Clayton Act.

Under the Pittsburgh plus system, the corporation and its subsidiaries quoted rolled steel products, made at and shipped from their plants at points other than the Pittsburgh mills, at the same prices that such deliveries would ordinarily cost if actually shipped from the Pittsburgh mills.

This is regarded by the Commission as "retarding business in all steel centers except Pittsburgh."

BUREAU OF LABOR STATISTICS INDEX NUMBERS—TWENTY-ONE BASIC BUILDING MATERIALS

Commodity	Index Numbers: At Peak Date	At Peak Index	March 1924 Index	April 1924 Index	May 1924 Index
Building material index	Apr. 1920	299.7	182.1	181.6	180.3
Brick, common, at kiln, Chicago	Oct. 1920	251.1	173.6	179.4	
Gravel, average for U. S.	Jan. 1921	233.7	200.2	197.5	197.7
Hollow tile, Chicago	June 1920	236.9	100.0	100.0	100.0
Lime, common, lump, average for U. S.	Oct. 1920	286.0	236.1	235.0	234.8
Portland cement, at plant	Sept. 1920	192.9	173.1	173.1	173.1
Building sand, average for U. S.	Jan. 1921	209.6	178.0	171.8	171.5
Bars, reinforcing, Pittsburgh	July 1917	327.1	174.4	174.4	169.0
Nails, wire, Pittsburgh	Jan. 1920	252.9	170.4	170.4	166.3
Structural steel, Pittsburgh	June 1917	331.0	165.5	162.2	157.2
Douglas fir, No. 1, at mills	Jan. 1920	407.3	200.9	190.1	190.1
Hemlock, No. 1, northern, Chicago	Mar. 1920	282.1	177.8	177.8	174.3
Lath, yellow pine, at mills	Feb. 1920	582.0	136.5	131.6	126.3
Red Cedar Shingles, at mills	Feb. 1920	346.8	157.1	137.8	126.1
Oak, white, plain, Cincinnati	Mar. 1920	419.0	168.9	183.8	189.2
Yellow pine flooring, at mills	Feb. 1920	455.3	191.0	189.1	180.9
Plate glass, New York	Aug. 1920	329.5	232.4	232.4	219.7
Window glass, f.o.b. works	Aug. 1918	295.2	162.7	162.7	162.7
Linseed oil, New York	Aug. 1919	480.4	200.4	194.8	202.6
Putty, New York	Jan. 1920	226.4	150.9	150.9	150.9
Turpentine, New York	Apr. 1920	601.8	239.3	225.4	210.5
White lead, New York	Mar. 1920	229.3	221.9	221.9	221.9

Cement Demand More Active Than Year Ago

The total output of portland cement for the entire country as estimated by the Geological Survey for the month of June, amounted to 13,538,000 bbl. as against 13,777,000, for the month preceding and 12,382,000, for the corresponding period in 1923.

Compared with a year ago the slight downward trend in production is seasonal. The drop from May to June, 1923 was 528,000 bbl., while the decrease during the same period this year was 239,000 bbl.

While mill stocks on hand July 1, were 1.498,000 bbl. under the quantity available June 1, they were at least 5,737,000 bbl. in excess of the amount carried at the same time last year.

The slight decrease in mill reserves was due to a commensurate gain in shipments during June, although last year witnessed a drop in both production and shipments from May to June.

The June gain in cement shipments shows that concrete and steel construction is still comparatively active.

Production, shipments and stocks of finished portland cement for the entire country, are shown in the following table:

	Production (Thousand bbl.)		Shipments (Thousand bbl.)		Stocks at End of Month (Thousand bbl.)	
	1923	1924	1923	1924	1923	1924
Jan.	7,990	8,788	5,628	5,210	11,477	14,155
Feb.	8,210	8,588	6,090	5,933	13,596	16,815
Mar.	9,880	10,370	10,326	8,995	13,045	18,189
Apr.	11,359	11,726	12,954	12,771	11,463	17,139
May	12,910	13,777	14,257	14,551	10,144	16,403
June	12,382	13,538	13,307	15,036	9,168	14,905

Over 23 per cent of the June output was made and consumed in Eastern Pennsylvania, New Jersey and Maryland. The next heaviest producing and consuming district was that comprising the states of Wisconsin, Illinois, Indiana and Kentucky.

Imports gained considerably over last year, while there was a corresponding drop in the amount exported.

Belgium was the heaviest exporter of cement to this country, with Norway next and Denmark third. Quantities also arrived from England, Germany, Canada, France and China during the month of May. The last two countries, however, sent extremely small amounts.

Los Angeles took the largest portion of the total importation, with Philadelphia second and Hawaii third. The other districts are named in the order of the quantities imported: San Francisco, Porto Rico, New York, Florida, New Orleans, Maine, South Carolina and Washington.

Contractors and Highway Commissioners, particularly in the Northwest, are being urged to ship as much cement as possible before late August and September at which time the grain movement will greatly increase the demand for good box cars.

Pipe Exports Gain During First Quarter

Exports of tubular products and fittings, including all kinds of pipes, pipe fittings and boiler tubes, gained 56 per cent during the first quarter of the current year as compared with the corresponding period in 1923, according to the Foreign Commerce Department of the U. S. Chamber of Commerce.

The money value of exports of this kind reached $8,229,000, compared with $5,265,000, for the same quarter last year.

Tubular products exported in the January-March period amounted to 150,000,000 lb., or 46 per cent above the quantity shipped abroad during the first quarter of 1923.

In the first quarter we exported 18 per cent more small construction tools (axes, saws, augers, bits, hammers, hatchets, shovels, spades) also metal working and pneumatic portable tools, than during the corresponding period last year.

During the same period, however, in which pipe exports were gaining over imports, the following appeared in *Engineering News-Record*, issue of Feb. 14, p. 305: "That foreign cast-iron pipe has entered the American market is revealed in the recent letting of a contract covering 48,000 ft. of c.-i. pipe for the Water Department of the city of Pasadena, Calif."

The contract, in question, involved 1,000 tons of French c.-i. pipe valued at $50,788, including fittings, which price was at least $6,000 under that of any of the American makers who offered bids.

Business Briefs

Call money continued at 2 per cent, July 21.

Time loans for short periods rated at 2¾ @ 3 per cent; longer terms at 3¼ @ 3½ per cent.

Commercial paper rates for best names, 3¼ @ 3½ per cent; other names, 3¾ per cent.

Forty-One Big Awards in Six Months Total $152,244,304

A compilation of the largest awarded contracts from Jan. 1 to July 1, follows. They have been classified and the tabulation will show where these various operations are taking place. Five large foreign contracts, two of which are in Japan, have been included because of their general interest.

LARGE CONTRACTS AWARDED DURING FIRST SIX MONTHS OF THIS YEAR, ACCORDING TO CLASSIFICATION

Classification	Location	Issue *E.N.-R.*	Cost	Size of Job	Successful Contractor
Waterworks					
	Kansas City, Mo.	Apr. 3	$1,395,412		Tibbetts & Pleasant
			1,873,295		Byrne Bros. Constr. Co.
	Oakland, Calif.	May 1	3,000,000	185H. x 75 W. x 1150 L., 1,260,000 cu.yd. earthwork (Reservoir)	Bates & Borland
	Providence, R. I.	May 29	1,799,210	Purification works	Winston Co., Kingston, N. Y.
Bridges					
Burnside bridge	Portland, Ore.	Apr. 17	$2,820,000	2,307 ft. 3 spans	J. A. Tillman & Co.
	Cleveland, O.	May 8	809,694	Concrete	Walsh Constr. Co.
	Philadelphia, Pa.	Mar. 27	404,850		Keystone State Constr. Co.
			2,880,000		American Bridge Co.
	Chamberlain, S. D.	May 1	346,234		Missouri Valley Bridge & Iron Co., Leavenworth, Kan.
Delaware River	Camden, N. J.	June 26	2,977,450		Keystone State Constr. Co., Philadelphia, P
Excavations					
Tunnel	Los Angeles, Calif.	May 1	$3,500,000		Twohy Bros., San Francisco
Channel	Lake Charles, La.	May 29	608,340		United Dredging Co., New York City
Drainage	Los Angeles, Calif.	Apr. 24	647,588		Francisco & Ellington
Tunnel	Copco, Calif.	June 26	4,000,000	2 miles	California-Oregon Power Co., Klamath Falls, Ore.
Buildings					
Hotel	Boston, Mass.	Jan. 17	$8,500,000	13 story 180 x 300 ft. rein.-conc. brick and stone	Olympia Constr. Co.
Office	Detroit, Mich.	Jan. 24	5,000,000	26 story 120 x 187 rein. conc. brick and stone	Davis & McConigle Co.
Hotel	Chicago, Ill.	Jan. 31	5,000,000	21 story 246 x 254 ft. fireproof	Starrett Bros.
Club and hotel	Detroit, Mich.	Mar. 27	3,500,000	12 story 177 x 183 rein.-conc., stone, brick, terra cotta	Everett Winters Co.
Apartment hotel	New York, N. Y.	Feb. 21	18,000,000	Brick, steel and stone	Todd, Robertson & Todd
Hospital	Cleveland, O.	Apr. 3	3,225,000	7 story brick, steel, conc.	A. Dall Constr. Co.
Hospital	Chicago, Ill.	Apr. 10	2,500,000	19 story 50 x 200 ft. fireproof	Dahl-Stedman Co.
Store	St. Louis, Mo.	May 8	3,000,000	10 story 160 x 160 ft. rein. conc., brick, stone and steel	Winmer Contg. Co.
Apartment	New York City	May 15	4,000,000	16 story brick, stone and steel	Day labor
Asylum	Secaucus, N. J.	May 22	3,367,111	Brick, stone and steel	W. H. & F. W. Cane Co., Jersey City
Hotel	Dallas, Tex.	May 29	3,250,000	18 story 141 x 200 ft. brick, terra cotta	Gilsonite Constr. Co.
Market	New York, N. Y.	June 5	2,841,986		Niewenhouse Co.
Hotel	Los Angeles, Calif.	May 8	3,500,000		Foundation Co.
Office	New York City	Apr. 3	5,000,000		J. Fishman & Sons, Inc.
Railroads					
Fla., Western & No. Ry. Co.	Florida	Feb. 28	$4,000,000	205 miles	Jefferson Constr. Co., Charleston, S. C.
Atchison, Topeka & Santa Fe	California	Mar. 6	2,500,000	44 mi. double track	Sharp & Fellows, Los Angeles
Southern Ry.	Tennessee	Apr. 10	3,000,000		Foundation Co., New York City
Northern Pacific Ry.	Idaho & Nevada	May 29	3,500,000	100 mi.	Utah Constr. Co., San Francisco
Unclassified					
Pipe line	Texas	May 8	$15,000,000	Duncan, Okla., to Corpus Christi, Tex., 15 pumping stations	Day labor
Power development	Watertown, N. Y.	May 22	2,000,000		U. G. I. Contg. Co., Philadelphia
Light and power	Somerset, Mass.	Jan. 31	3,500,000		Stone & Webster, Inc., Boston
Federal Government					
Lock	Uniontown, Ky.	Feb. 28	$1,500,000	Lock for Dam 49	Hired labor
Dike and sluice	Wilmington, Del.	Apr. 10	472,950		Triest Contg. Co., New York City
Lock	Brookport, Ill.	June 5	1,500,000		Day labor
Industrial					
Repair shop	New York, N. Y.	Jan. 24	$2,325,000		Willetta Constr. Co.
Power plant	Long Beach, Calif.	Feb. 28	8,000,000		Stone & Webster, San Francisco
Gas station	Syracuse, N. Y.	May 22	3,000,000		United Gas Impvt. Contg. Co.
Dams					
Completion of Wanaque dam	Newark, N. J.	Mar. 13	$3,318,990		C. F. MacAvoy Co.
	Tacoma, Wash.	Apr. 10	881,194	Conc. arch dam 175 ft. high	A. Guthrie & Co., Portland, Ore.
No. of contracts 41	Money value		$152,244,304		
Foreign Work					
Bank and office	Tokio, Japan	Mar. 13	$7,500,000		J. Stewart & Co., New York City
Street and offices	Buenos Aires, Argentina	May 29	35,000,000		Geo. Nolan, Inc., New York City
Sanitary and waterworks systems	Peru	June 5	50,000,000		Foundation Co., New York City
Water works and sewers	Angora, Turkey	June 25	2-3,000,000		Ulen & Co., New York City
Railway electrification	Tokio, Japan	June 15	1,500,000		Westinghouse Electric International Co., New York City

New York State Has Heaviest Paving Week Since 1922

There were more finished pavements laid in New York State during the week ended July 18, than for any week this year or last, according to the Bureau of Highways, N. Y. State Dept. of Public Works. A total of 166.2 mi. of pavement has been completed up to July 21 this year as against 156.7 mi. in 1923 and 144.1 mi. during 1922.

The aggregate of contracts now under way is 186, while eighty-eight new projects are in process of construction. Men employed by contractors number 7,740; a maintenance force of 4,977 men is furnished by the State. A total of 267,103 sq. yd. of pavement were completed during the week of July 21, with 1,723,587 sq. yd. finished so far this season.

Bids Wanted on Big Jobs

Among the projects on which bids are either asked or will soon be called for in Construction News, pp. 43 to 55, are the following:

Library, Los Angeles, Calif., by Library Directors, $1,350,000.

Apartment, Philadelphia, Pa., by Sugarman, Hess & Berger, $1,000,000.

Temple, New Castle, Pa., by Masonic Assn., $1,000,000.

New Union R.R. Station, Toronto, Ont., Can. Nat. R. R., $2,000,000.

Large Contracts Let During Week

Among the week's announcements of contracts awarded in Construction News, pp. 43 to 55, are the following:

Municipal Building, Brooklyn, N. Y., to Cauldwell-Wingate Co., $4,174,800; heating and ventilating, $222,340, to Gillis & Geoghegan.

Plant, Chicago, Ill., Hall Printing Co. to J. W. Snyder Co., $2,000,000.

Apartment, New York, N. Y., Omaha Realty Co., by day labor, $1,000,000.

Next week—Where construction is heaviest. Contracts let in U. S. for first six months of this year and last.

Weekly Construction Market

THIS limited price list is published weekly for the purpose of giving current prices on the principal construction materials, and of noting important price changes on the less important materials. Moreover, only the chief cities are quoted.

Valuable suggestions on costs of work can be had by noting actual biddings as reported in our Construction News section.

The first issue of each month carries complete quotations for all construction materials and for the important cities. The last complete list will be found in the issue of July 3, the next, on August 7.

Steel Products:	New York	Atlanta	Dallas	Chicago	Minneapolis	Denver	San Francisco	Seattle	Montreal
Structural shapes, 100 lb.	—$3.34	$3.80	$4.20	—$3.10	—$3.35	$4.10	$3.60	$3.60	$4.20
Structural rivets, 100 lb.	—3.75	4.35	4.90	—3.50	—3.75	5.15	5.00	4.25	6.00
Reinforcing bars, ¾ in. up, 100 lb.	—3.24	3.30	3.38	—3.00	—3.25	3.87½	3.65	3.50	2.70
Steel pipe, black, 2½ to 6 in. lap, discount	44%	55%	43%	47%	55.05%	36%	36.80@49.10%	45%	47.43
Cast-iron pipe, 6 in. and over, ton	60.60@61.60	45.50	—58.50	—56.20	58.50	68.00	59.00	65.00	65.00
Concreting Material:									
Cement without bags, bbl.	2.50@2.60	2.35	2.05	2.20	2.42	2.84	2.61	2.90	1.90
Gravel, ¾ in., cu.yd.	1.75	2.00	2.38	2.75	1.85	1.90	2.15	1.50	1.25
Sand, cu.yd.	1.00	1.40	2.00	2.75	1.25	1.00	1.50	1.50	1.25
Crushed stone, ¾ in., cu.yd.	1.85	2.00	2.83	3.00	1.75	3.50	2.15	3.00	2.25
Miscellaneous:									
Pine, 3x12 to 12x12, 20 ft. and under, M.ft.	57.00	36.00	57.20	+57.00	38.75	36.75	—32.00	22.00	60.00
Lime, finishing, hydrated, ton	18.20	22.50	20.00	18.00	25.50	24.00	22.60	24.00	21.00
Lime common, lump, per bbl.	3.00@3.25	1.65	1.85	1.50	1.40	2.70	2.15	2.80	10.50
Common brick, delivered, 1,000	21.45@23.65	11.00	14.10	12.00	13.00	12.00	15.50	15.00	20.25
Hollow building tile, 4x12x12, per block	Not used	.091	.11	.094	.08	+.085	.....	.11	.12
Hollow partition tile 4x12x12, per block	.1162	.091	.11	.094	.....	+.085	.108	.11	.10
Linseed oil, raw, 5 bbl. lots, gal.	+1.03	+1.11	1.14	+1.05	+1.14	1.18	1.05	1.13	1.01
Common Labor:									
Common labor, union, hour	.75	.30	.....	.87½	.....	.50@.55	.55	.62½	.....
Common labor, non-union, hour	....	.25	.30@.50	.82½	50@.55	.35@.50	.50	.62½	+.25@.35

Explanation of Prices—Prices are to contractors in carload lots unless other quantities are specified. Increases or decreases from previous quotations are indicated by + or — signs. For steel pipe, the prevailing discount from list price is given; 45-5% means a discount of 45 and 5 per cent.

New York quotations delivered, except sand, gravel and crushed stone, alongside dock; common lump lime, in 280-lb. bbl. net, and hydrated lime f.o.b. cars; tile "on trucks"; linseed oil and cast-iron pipe f.o.b.

Labor—Concrete laborers' rate, 93¾c.; building laborers (pick and shovel men) 75c. per hr.

Chicago quotes hydrated lime in 50-lb. bags; lump finishing lime per 180-lb. net. Lumber delivered on job.

Minneapolis quotes on fir instead of pine. Brick, sand and hollow tile delivered. Cement on cars. Gravel and crushed stone quoted at pit. We quote on brown lime per 180-lb. net; white is $1.80 for Kelly Island and $1.70 for Sheboygan. Common labor not organized.

Denver quotes on fir instead of pine. Cement "on tracks"; gravel and sand at pit; stone on cars; lime, brick, hollow tile and lumber on job. Tile price is at warehouse. Linseed oil, delivered, in wooden bbl. Common lump lime per 180-lb. net.

Atlanta quotes sand, stone and gravel per ton instead of cu.yd. Common lump lime per 180-lb. net.

Dallas quotes lime per 180-lb. bbl. Steel, cement, cast-iron pipe and crushed stone f.o.b. cars, other materials delivered.

San Francisco quotes on Heath tile, size 5½ x 8 x 11½. Prices are all f.o.b. warehouses except C. I. pipe, which is mill price plus freight to railway depot at any terminal. Common lump lime per 180-lb. net. Lumber prices are to dealers in yards at San Francisco, for No. 1 fir, common.

Seattle quotes on Douglas fir (delivered) instead of pine. Lump finishing lime per 180-lb. net. Hollow building tile delivered. Hydrated lime in paper sacks. Sand and gravel at bunkers.

Montreal quotes on pine lumber. Sand stone, gravel and lump lime per ton. Stone, lime and tile are delivered; sand, gravel and cement on siding; brick f.o.b. plant; steel and pipe at warehouse. Hollow tile per ft. Cement price is in Canadian funds (the Canadian dollar stands at 99.25). Bag charge is 80c. per bbl. Discount of 10c. per bbl. for payment within 20 days from date of shipment. Steel pipe per 100 ft. net; 3-in., $47.43; 6-in. $119.

Conditions Affecting the Market

That the undercurrent of business is still fairly strong is evidenced by recent developments in the following important directions: (1) A steady increase in contract letting since the first week in July; (2) unusually heavy cement shipments from mills; (3) gain in structural steel bookings; (4) improvement in lumber demand; (5) increase in freight loadings, particularly of grains, grain products, coal and ores; (6) better sentiment in grain, textile and leather markets.

The effect of curtailment in production at mills has been to cause depletion of reserve stocks and consequent firmness in prices of certain materials.

Linseed oil, for instance, rose sharply in Chicago, Atlanta and New York during the week. Hollow tile advanced in Denver and pine timbers in Chicago. Weakness is still apparent, however, in prices of heavy rolled steel products in New York, Minneapolis and Chicago and in c.-i. pipe in Dallas and Chicago.

In cases where reserve stocks have been exhausted, prompt mill deliveries of comparatively small quantities now serve to prevent any definite steps in the direction of replenishment.

With current demand confined to immediate needs, no well defined buying movement is anywhere in prospect.